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## THE TREATMENT OF MEDICINE IN FICTION.

BY CAROLINE W. LATIMER, M.D.

One of George Eliot's happiest minor touches is that in which she describes Lydgate as having "in perfection the medical faculty of looking perfectly grave, whatever nonsense was talked to him."

Most persons, although they ostensibly send for a physician to obtain the benefit of his advice, are really far more anxious to expound to him their own ideas uncontradicted, than to hear his opinion; and the capacity to listen, with at least the appearance of interest, to irrelevant information and incorrect assertions, constitutes no small element in professional success. It is recorded of Sydney Smith that on one occasion he amused himself by inventing a place of future torment for each of his friends. "And you, Macaulay," quoth he, "shall be dumb, and shall be forced to listen to false dates of the reign of Queen Anne shouted into your ear." All medical men know what it is to be placed in a position similar to that proposed for Lord Macaulay, with this important difference, that their silence under provocative inaccuracy is due to the knowledge that no inconsiderable part of a professional income depends upon it. But, although silence may be golden under such circumstances in real life, its value is not the same when the erroneous statements upon medical subjects are made in novels, and there is every reason for entering a protest against the vague,

false and impossible statements that are scattered broadcast by almost every novelist.

This is the age of realism in fiction. It is now the avowed aim of every author to develop his subject with the most careful attention to detail, and, therefore, erroneous statements, even in specialties, are no longer excusable on the ground that those whose thoughts travel only in the realms of fancy cannot be expected to express themselves with perfect accuracy on practical matters. Disease and death are ever present with us in real life. They must of necessity play an important part in that department of literature that deals exclusively with the events of human lives. Some reference to subjects within the province of medicine is necessary in almost every novel, and, therefore, the creators of novels should take heed to their ways.

A great deal has been said recently (and said truly) as to the lack of training in those who rush into the writing of fiction, but it would be clearly unreasonable to expect a medical, or, indeed, any other specialized education, as a preliminary to entering on the career of a novelist. Yet when it is considered that the sources of correct information are numerous and easy of access, it seems not unreasonable to suggest that they should be occasionally consulted. The number of laborers in the field of medicine is large, and the harvest (unless it happens to be a cholera year) is not sufficient to keep the greater part of them employed to the full extent of their time. It is hardly likely that any novelist is completely out of reach of some member of the profession who could supply him with the information necessary for his purpose.

If we except a certain species of literature that has recently arisen, whose avowed object is the presentation of medical details with doubtful accuracy, and more than doubtful taste, the treatment of medicine in novels seems to divide itself into four classes.

In the first place there are those rare and precious instances which are entirely correct. We shall have occasion to return to these later, so that it is sufficient at present to

call attention to the fact that they exist; and, as an example granted, to mention the description of Osborne Hamley's aneurism in "Wives and Daughters," or Mr. Casaubon's heart complaint in "Middlemarch."

The second class of cases deserves only a passing notice. It is that in which the author permits himself and the reader a gentle jest at the expense of the medical profession. Constance Fennimore Woolson must have been moved by such a spirit when she describes her heroine, Anne, as being requested, for purposes connected with the development of the story, to assume a complaint known as "dancing marrow of the spine." It is impossible to suppose that Miss Woolson really believed, or wished her readers to believe, in the existence of such a remarkable ailment. Not many years ago the extreme and unguarded use of mercury, especially calomel, was characteristic of old-fashioned and ignorant practitioners of medicine; and Thackeray has made excellent use of this error when he describes Becky Sharp's attempts to ingratiate herself with the Dowager Lady Southdown, whose foible was amateur doctoring of the most vigorous description. "Rebecca attacked her on the nursery question at once, and declared that her own little boy was saved, actually saved, by calomel freely administered when all the doctors in Paris had given the dear child up."

But by far the largest number of medical statements in fiction belong in one or other of the two remaining classes. These are, first those cases in which distinctly false statements are made and itemized; and secondly, those in which the author having, it would seem, justifiable doubts of his own capacity to deal with medical subjects, takes refuge in the most extreme vagueness of allusion. In the former class, although the erroneous statements are very numerous, they display a curious lack of variety. Novelists, as a rule, ring the changes upon a limited number of diseases, which they appear to regard as a part of their stock in trade. Amongst these the universal favorite is brain fever; the use of it, to be sure, is not quite so extensive as it was a few years ago, but it holds its own very well, far too well, considering that

it has no existence except in the brains of authors. It must be frankly admitted that the total extinction of such a useful disease would be a great loss to writers of romance; for it is only reasonable that a hero or heroine who has lived through the storm and stress of a three volume novel should break down under the strain and require a period of retirement from the world, which can be utilized by the author to attend to affairs of minor importance. And it is but just that when the existence of a disease is denied, or its unsuitability demonstrated, the critic should offer some alternative. I would humbly suggest therefore that nervous prostration of a severe form might be a useful substitute for the time-honored fever of the brain. The forms under which nervous prostration manifests itself are so many and so varied that an author can hardly go amiss in any development that may suit his purpose. It always obliges complete and prolonged seclusion from all outside interests; in extreme cases it may pass over the border line into insanity, and such a result, or even the dread of such a result, would often, it seems, be of great service. As nervous prostration is not accompanied by fever, it will not meet those cases in which immediate danger to life is necessary to the progress of a novel; nor those in which it is desired to utilize the ravings of delirium. For such conditions, however, I should think (speaking of course as a fool) that typhoid fever with cerebral symptoms would be an adequate provision. The number of cases of typhoid fever in which cerebral symptoms occur is not large, but they are by no means uncommon, and they are always of the most serious nature. That typhoid fever is an infectious disease, and not directly the result of nervous excitement and prolonged fatigue, is no objection to its use; the germs of disease are always present with us, and the course of events in almost any novel affords a satisfactory predisposing cause.

Contagious diseases fare tolerably well at the hands of the novelist, owing, probably, to the fact that he has had personal experience of several, if not all, of those in common use. Still, very startling statements do occur even in reference to contagious diseases; as in a case that I recently met

with, where scarlet fever was described as being no longer dangerous to a visitor, "the original disease having passed into typhus." Tuberculosis, at least tuberculosis of the lungs, is also treated with fair respect, for it is, unfortunately, of such common occurrence that every one has had ample opportunity to observe its progress. But it is greatly to be wished that writers of fiction could be induced to abandon what they call "breaking a blood-vessel" as a cause of instant death. It is very rare, indeed, for death to occur in consumption as the direct result of hemorrhage; so rare that many physicians, with years of experience, have never met with an instance of it. But with the writer of romance all things are possible, and in novels hemorrhage from the lungs is always fatal, and almost always immediately so. Heart disease is a complaint that is treated by the novelist, not so much with incorrectness as with misapplication. It is used by him just as "breaking a blood-vessel" is used, only to produce sudden death. Some forms of heart disease do undoubtedly terminate fatally without a moment's warning, but these cases are far less numerous than others of a different kind, in which the end is preceded by a lingering and painful illness. Indeed, this more common form is accompanied by such prolonged suffering that it could be used very appropriately to punish the evil-doer for his misdeeds, and give him time for repentance, rather than to cut him off in the error of his ways, for which latter purpose it is almost invariably employed.

So much for that class of cases in which the author distinctly itemizes erroneous statements. The remaining class is that in which everything except the merest outline is left to the reader's imagination. In such cases the author, so to speak, signs a blank check, which the reader may fill out for himself, "Throat trouble," "spinal weakness," "a nervous affection of long standing," are some of the stock expressions with this class of writers. They may be perfectly correct, as far as they go, but their limit is never defined, or their suitability to the circumstances in which they occur demonstrated. "Stomach complaint" undoubtedly does exist; at least no one will undertake to say that there are not com-

plaints of the stomach, but the reader may reasonably expect some data by which an ordinary attack of indigestion, that is sufficient to prevent the hero and heroine from meeting at a picnic, can be distinguished from cancer, which marches onward with a death-warrant in its clutches. Again, "internal inflammation" is a term wide enough and vague enough to cover about half the diseases, acute or chronic, that flesh is heir to, but we are none the wiser for being told that a fictitious character suffered from it. The novelist probably intends it to cover only inflammation of the organs in the abdominal cavity, and that is giving it a wide range, but the expression, as it stands, places no restrictions which prevent its including the heart, lungs, spinal cord or brain.

In my childish days I sometimes attended fairs, or other entertainments designed to extract money for charitable purposes from the uncharitable, and I always chose to invest a considerable part of my small capital in what were then known as "*grabs.*" That is to say I exchanged a small sum of money for the privilege of thrusting my arm up to the elbow into a large bag, in charge of another child of about my own age, who seemed to me the favored of the Gods. The bag contained a number of small parcels done up in wrapping paper, one of which I extracted (after due consideration), and which became my own property. There was a period of suspense while I removed the wrappings, and then I stood possessed of ——— oh, joy! it might perchance be a Jew's-harp, or alas (I give a concrete instance), it might be a case for spectacles. Whatever it was I must accept it, for better or worse, as the equivalent for my money, and my needs and desires must be accommodated accordingly. The thought has sometimes occurred to me that the writers of novels belonging to either of the two classes last spoken of, must employ some means analogous to this for introducing medical matters into their books. Indeed, I have even gone further, and thought it possible that each author kept on his or her desk a copy of one of the almanacs issued by the proprietors of quack medicines (say Hostetter's Bitters), and, whenever he or she wished to introduce an ailment of any

kind into a story, they opened the book at random and copied down a train of symptoms from the first testimonial of efficacy that met their eyes.

If it is surprising that inappropriate diseases are so frequently met with in fiction, it is no less astonishing that others that are really suitable should be wholly neglected. Time and space forbid us to enter into any detailed discussion of these, but I cannot refrain from calling attention to the fact that pneumonia deserves to find more favor in the eyes of the novelist than it has done hitherto. It is difficult to see why so prevalent a disease should have attracted so little attention. Any allusion to it in literature is very rare, and yet its characteristics are of a kind that would seem to suggest its frequent use in fiction. In the first place, it ends by crisis, and it is almost the only disease that does so, out of the whole number that Pandora let loose upon us. In novels, acute diseases almost always terminate suddenly, for obvious reasons, and, therefore, it is the greater pity that, when truth and fiction meet, they should not go hand-in-hand. This crisis in pneumonia takes place generally upon the tenth day. The fever, which has been very high, subsides in a few hours, it may be in almost a few minutes; the patient falls into a profuse perspiration, and then, in favorable cases, he drops into the sweet sleep that every novelist loves to depict. If the disease ends fatally the patient dies shortly after the crisis occurs, usually from exhaustion. Could anything be more ideal from the point of view of an author? Yet this is only a small part of the claims that pneumonia has upon his attention. As a rule, the onset of the illness is sudden, but there are a certain proportion of cases in which the victim is unwell for a day or two previous to the attack. The length of the illness is, as I have said, about ten days, but it sometimes terminates much sooner. The fever is always high, and there may be raving delirium, or there may be stupor, or there may be complete possession of the senses. In short, the sinner can be cut off in the error of his ways without space for repentance, or the righteous have time and opportunity for an edifying deathbed. Secrets

upon which the whole interest of the plot turns may be revealed during the ravings of delirium, and on the other hand, facts of the utmost importance may be buried in the grave without the possessor having a moment of perception sufficiently clear to make them known. There is time for excited feeling to betray any amount of unsuspected affection, or any number of complications may arise from its never being known.

Even more than this, pneumonia has a peculiarity that does not exist in any other disease. There sometimes appears in it what is known as a "false crisis;" that is to say, the fever suddenly subsides and the patient seems on the high road to recovery, when the temperature rises again as suddenly as it had fallen and every evil symptom returns. Such cases usually end fatally, and the many and varied ways in which this could be utilized by the novelist are too plain to need comment. It would almost appear that when a kind Providence created the bacillus of pneumonia it provided for the needs of writers of fiction, and that writers of fiction are in no wise different from other classes of men in that the gift has been entirely unappreciated.

I hope that I have said enough to justify my assertion that reform is needed amongst novelists in regard to their treatment of medicine; but it may now be asked what is the remedy for such a state of things? A strict sense of duty in fulfilment of work undertaken has always been, and will always be, efficacious for many of the evils under the sun. It will be found in fiction, as it is elsewhere, that careful avoidance of every detail that cannot be verified, and, above all, security as to the accuracy of those details which are made use of, will give the desired result. I have already alluded to the few rare instances in literature where all matters connected with medicine are treated correctly. These are certainly exceptional, but enough of them exist to show that they are possible, and the author who gives us the best illustration of such cases is certainly George Eliot.

The exact rank which this great novelist is entitled to hold in literature has yet to be determined. The generation

that grew up, as it were, under the shadow of her genius, believed her to be without a defect. But the succeeding generation is now of an age to speak its mind, and with the confidence of all young and untried spirits is critical as to the judgment of its predecessor. Let us bow to the rising sun; there may be justice in the new opinions. Perhaps it is true that George Eliot's ethical purpose is too marked; that her learning is oppressive; it is hard for us to see it, but she may even be didactic, and her heroes may not be attractive, at least to the maidens of to-day. But even her most unfavorable critics will not venture to suggest that she is anything but correct. I do not think there is a statement of any kind in her writings that cannot be verified, and I am perfectly sure that whenever an allusion occurs in her novels to disease or death it is absolutely exact. She never obtrudes her medical items; no details are pressed upon us that good taste should withold, yet, in all essentials, her descriptions are as true to nature as if they had been written for the pages of a medical review. Fred Vincy's typhoid fever, Dempster's delirium tremens, Mr. Tulliver's paralytic stroke and subsequent decay are presented to us as correctly as they could be by a medical man himself. But this perfection of accuracy is not the result of inspiration. We cannot imagine that even George Eliot's genius could have embraced a knowledge of one of the learned professions by intuition. Yet we know that she never studied medicine, and, although no doubt she must have thought out carefully for herself the morbid conditions necessary for her purposes, she could never have presented them with the truthfulness that she finally attained without first submitting them to the criticism of reliable authorities. That she did do so in one specialized subject, we have evidence in an article recently published by Mr. Frederic Harrison in the *Forum*. He says:

"In Felix Holt I was naturally much interested, having read it in manuscript and advised upon the point of law, as appears from her published letters in the 'Life' by J. Cross. There are two or three lines—the lawyer's 'opinion on the case'—which she asked me to sketch; and I remember tell-

ing her, when she inserted these lines in her book, that I should always be able to say that I had written at least a sentence that was embodied in English literature."

It seems not unreasonable to infer that George Eliot was as careful in regard to her treatment of medical matters as she was in those pertaining to the law, and while it is true that very few authors can command an advisee of such eminence as Mr. Harrison, they can certainly refer to some good authorities who can give them reliable information in law or medicine when they desire to introduce these subjects into their books. And, if we were able to investigate those cases in which medical matters are discretely handled by the novelist, I think we should find that his knowledge was always derived from a fountain head.

The new generation, to whom the beginning of the century belongs, will have great opportunity to improve upon the old. This is a fact of which they are not slow to remind us, and, therefore, we in our turn may fitly ask those among them who devote themselves to literature, to bestow special attention upon two points in which we ourselves must plead guilty to faults, both of omission and commission, in our day and time. Let us hope that the new era will bring with it a marked improvement in fiction, first in the avoidance of medical subjects altogether as *themes* for novels; and secondly, in the treatment of those subjects when they are incident to the events of the story, with good taste, careful consideration and accuracy.

## THE WILL.

By C. K. Heath.

The gravitation of two bodies for each other, bodies of such weight that we might hold them in our hands, is too small to be perceptible. Considering that this attraction varies inversely as the squares of the distances, how far beyond our conception would be the weakness of this attraction between two molecules of matter at a distance from each other of that of Neptune from the sun. Yet the combined attraction of all the molecules of the sun for one molecule in Neptune is sufficient to guide that molecule with its mates in that planet's orbit around the sun. Every atom has its place and influence in nature. So, too, has every impulse and action; nothing is lost whether it be matter or motion. Every change, however trivial it may seem, induces other changes; every motion is followed by its consequential motions; motion never dies, it only changes form; it cannot cease at one point without appearing at another; the results of every motion will be a continuing series of motions, simple, compound and potential, for all time to come. We cannot conceive of such a series, or any part thereof, ever becoming impotent, as incapable of producing further changes. These are generally accepted facts.

Now let us trace our series backward. Every event has its one or more inducing events. Can we conceive it as being otherwise? Can we conceive of this series of actions and results, this chain of causes and effects, as having a beginning? Can we trace it backward until we come to a point when we can say that this movement came from nothing? that there was a change in nature's realm, but there was no antecedent change or action to produce it? That would be equivalent to saying that motion had been created—that the total motion in the universe had been increased.

Then, too, this primal change would be spontaneous; there would be no reason for the change. We would have a new

condition without there being a cause to produce it. Action under these conditions seems impossible and the idea ridiculous; yet these would be the conditions under which man must act if he possesses self-acting spontaneity or free will. There was a time when people thought the wind had free will—that it exercised volition. They placed a spiritual motor behind every movement they could not otherwise explain. Is it not time now to revise our theories of psychology that postulate the free will of man? When man exercises choice, he must act; his choice would be an event in nature; if free, it must be without cause. If we do not have a complete chain of sequences reaching backward indefinitely we will have spontaneous action, that is, action without a cause. What can be more plain and logical than this? If there is a cause for the change of state it could not be free and spontaneous.

If it is answered that man is a primal cause, that he has creative faculty, his choice would still be spontaneous, and would be an event without a cause the same as before. Even though you make man a supernatural being, spontaneous action by him remains unexplained. Observe the various changes going on in the visible universe; see how uniformly those changes obey a regular order—like conditions producing like results; we name this regularity and order natural law. Who can say that this order applies only to the inorganic world? or that it applies only to that and the lower order of life forms? How can all the rest of the world be subject to law and order and man be exempt? Animal activities appear free because of the extreme complication of conditions under which they act.

A judge upon the bench will always decide a case strictly in accordance with natural law, however far he may depart from human law; the testimony and the surrounding influences acting upon his nervous organization—that is, his natural disposition—will bring about as exact results as will the movements of the bodies of the solar system. The one we can predict more accurately than the other only because it is more simple. Shakespeare says "Nature is made better by

no mean, but nature makes that mean; so, o'er that art that you say adds to nature, is an art that nature makes." A fair interpretation of that would be, that all phenomena are events of nature or natural sequences; that, whether nature acts through conscious beings or otherwise, the result is the working out of a definite course from cause to effect; a course that we could foresee could we but penetrate nature's recesses as we do a watch or a music box. If the will of man is free, then so must be that of the dog or ape and also the worm, and so on down to the protozoan; in all these consciousness and will power differ only in degree, not in kind. It is said that if a drop of acid is placed upon the leg of a frog that has had its brain removed, the other leg tries to brush it off; showing that a brain centre is not necessary for the manifestation of will or apparent volition. Apparent volition is frequently observed in the vegetable kingdom. Who can draw a line across life's progression series, and say that above the line life has volition but below it has not? The belief is almost universal that we are free voluntary agents. We all feel that we have an elective preference; a spontaneous volition. It may be asked how can this be reconciled with the idea that all our actions are the rigorously necessitated outcome of mechanical laws? that they are not spontaneous but consequential? that all motions including vital activities and so-called voluntary movements result from the strictly determined play of mechanical forces?

That we are free in one sense is admitted by all; we are free to carry out the impulses of the mind; but whether we are free to determine those impulses is the question in dispute.

Spinoza throws some light on the subject when he says: "The human freedom of which all boast, consists of nought but that men are conscious of their own wills while ignorant of the causes that have induced them." It would appear from this that there are activities of the brain of which we are unconscious. The ordinary order of psychic action consists of sensation, reflection, judgment and will. Consciousness is incident to the beginning and ending of

this chain or series, but it does not follow all the way through; it is obscured between these extremes. That part of the series that coördinates immediate impressions with past impressions, that harmonizes sensation with the natural character, seems but faintly conscious to us. Therefore, when an impulse bursts out in consciousness, we, not being able to trace the causes that induced it, usually say that it was our spontaneous voluntary act. Until recent times people supposed that the larvæ of insects came forth spontaneously. Do we not make a similar mistake in supposing that our impulses are spontaneous. It may be granted that we cannot fully realize, in thought, the absence of free will; though we might realize it objectively, we will probably never be able to do so subjectively. But neither can we realize that there is no up and down to the universe. It seems quite clear that all phenomena can be nothing else than the action, reaction and interaction of natural forces. Natural law is only another name for the properties of matter. Every movement is a factor in the series of causes and effects that marks out nature's course; unless this series or chain is continuous there can be no stability in nature. If you introduce the hypothesis of free will, nature becomes a world of chance; natural law could not then work out definite results, because the whole course of events would be subject to the caprice of the free election of animate beings; even a worm or a fly could change the course of nature. There must be continuity in the series of causes and effects. There must be no breaks in the chain of consequential action. It will not do to say that free acting human souls could form connecting links in this chain, for in so far as they are free they are spontaneous and would not have antecedent inducing causes for their particular action, therefore they could connect nothing. If we exclude the idea of spirituality for the moment, and define mind as being a state of consciousness or a psychic state of the nervous system, and thought as psychic activity, then the exercise of mental, choice necessitates some degree of brain action, and, to act the brain must be acted upon. The response of the brain to

external influences may be immediate or it may follow a long time after, but surely no exercise of the will was ever made without a motive, and motives cannot arise subjectively. A motive may be defined as a tendency or desire to adjust the organism to its environment; it is determined by the environment and the needs of the organism. Motives are to the mind what gravitation is to the stream, it is that which causes motion. Motives induce or determine the impulse, the impulse determines the will, and the will determines physical action. Therefore every action of the mind must depend on some antecedent event. If we define mind as being a spiritual entity, the foregoing reasoning applies the same, and spontaneity is as impossible in the one case as in the other. For if a spirit exercises choice there necessarily must be action, and who can conceive of anything changing from a state of rest to a state of activity without objective stimulation—without being acted upon by something other than itself.

In the latter definition we introduce an element of mysticism, and that which was intricate and obscure becomes impenetrable. The question may not yet be devoid of mystery, but it will not be made plainer by placing a greater mystery behind it. A free-will spirit could not form links in the chain of consequential action, and as a spirit without free will would be a useless invention, the whole theory of spiritual existence appears incompatible with the doctrine of continuity of cause and effect, and must fall to the ground.

XUM

# AZOTIC NUTRITION OF VEGETABLES.

Adapted From the French of Louis Mangin.

By Rosa G. Abbott.

Azote or nitrogen is a gas, which, mingled with oxygen, forms the atmosphere in which we live. As its name indicates (*a*, privative, conveying the idea of negation, and *zoon*, animal) azote does not maintain life, and organisms perish in the air from which oxygen has disappeared. Is azote, then, an inert gas, without importance in the constitution of animals and vegetables?

When matter obtained from the bodies of living creatures is classified (*i. e.*, organic matter), a distinction is made between that containing nitrogen and that which does not. The first, known as nitrogenous matter, comprises such substances as albumen, blood, caseine, leguminous matter, gelatine, etc. The second or non-nitrogenous are, for example, starches, sugars, fats, etc.

A consideration of living matter reveals in its constitution a complex combination of nitrogenous substances. A deficiency of nitrogen leads to the dissolution of animal or vegetable tissues. Thus the dogs nourished by Magendie upon aliments deprived of azote (starch, sugar, butter, etc.,) soon died of inanition; and plants cultivated in a locality deprived of this gas rapidly perish.

Nitrogen, in spite of its apparent inertia, is, then, indispensable to life. We shall show by what method and under what forms it is introduced into the plant.

It is well known that the nutrition of vegetables differs from that of animals. The latter are nourished exclusively upon organic aliments, which they borrow either from the bodies of other animals or from vegetable bodies. Green plants, that is to say those whose tissues contain the coloring matter called chlorophyl, are incapable of nourishing themselves upon organic matter. The essences incorporated in their constitution can only be absorbed in the form of

mineral matter. It may be cited, by way of exception, that certain vegetables destitute of green coloring, such as mushrooms and some of the sea-weeds, are nourished directly from organic matter. Among the mineral aliments of plants the gaseous (such as carbonic acid) are absorbed by the aerial organs. The others, in solution in the humidity of the soil, are absorbed by the roots. Such is the case with the different salts, phosphates, etc.

What, then, are the diverse sources from which the plant may draw the nitrogen necessary to its constitution? They are varied, and may be classified as follows:

*First.* Gaseous nitrogen, which exists in the atmosphere, where it forms an almost inexhaustible reservoir. In this state it penetrates the earth, and is found in solution in all water.

*Second.* Nitrogen, in combination with organic matter, occurring wherever there is animal or vegetable detritus.

*Third.* Ammonia and its salts, which occur in all regions where organic nitrogenous matter is found in a state of putrefaction. It is the constant product of fermentation effected by microscopic organisms at the expense of nitrogenous matter. Feeble at low temperatures, this fermentation is very active during the heat of summer; explaining why excretions of all kinds emit at this season a strong ammoniacal odor.

*Fourth.* Free nitrogen and its oxides existing in the air or in the soil; comprising nitrogen, nitrous acid and nitric acid. In the air these oxides are formed in minute quantities during a thunder storm by direct combination with oxygen. But this production is of minor importance compared with the phenomenon of nitrification; a process long known, but of recent applicability. It consists in an oxidation of the ammoniacal salts which form nitrates; this oxydation being the work of the ferments which exist in all soils, even in those covered for centuries by eternal snows. In stabl certain walls are often seen covered with a white powde similar to frost, which the animals eagerly lick. This powde is composed of fine ammoniacal salts. In Chile and Peru,

where the absence of rain permits the otherwise soluble nitrates to accumulate upon the surface of the ground, nitrification is so active and rapid that nitrate of soda is deposited in layers and is used as a fertilizer. The nitrogenous detritus in the soil continually undergoes, by means of the microscopic organisms which inhabit it, a series of transformations; at first ammoniacal fermentation which finally forms ammoniacal salts; then nitrification, which by oxydation of the ammoniacal salts forms the nitrates.

It will be seen by this enumeration that nitrogen exists in diverse conditions in the air and soil surrounding vegetation.

Are all these forms valuable for the nourishment of the plant? If not, which are prefered? To answer these questions it will be essential to distinguish two orders of plants.

*First.* The autogamous plants, or plants consisting of a single individual.

*Second.* Allogamous plants, consisting of the union of two different species, which grow in intimate juxtaposition, and by their common life form a new growth whose vegetation is often more active than that of the separate individual. This common life (symbiosis) is a veritable association with reciprocal benefits. The most remarkable illustration of this i fe is afforded by the lichens—plants which fasten upon trees, earth or rocks. These are not autogamous plants, but the result of the association of a green alga and a fungus; and the organization resulting from this association can live under conditions where the isolated alga or fungus would perish. Lichens vegetate upon the most stubborn soils, and upon mountains or in the polar regions they constitute the last representatives of life. A certain number of cases of symbiosis or associated plants are now known; the most important from a nutritive point of view are those which result from the combination of a green plant with a colorless plant (mushroom or sea-weed). Thus the legumes (trefoil, lupine, pea, etc.) form, in combination with a colorless alga, an association at their roots with a bacteria called bacteria radicicolus, which promotes the formation of the radicle tubercles characteristic of these plants. The humiculus plants, that is

to say, those which live in the black earth of forests, or mold, (forest trees, oak, beech, pine, etc.) through their root-tissues also establish an intimate union with the mycelium of certain mushrooms, constituting the formation known as mycorhiza. But while the association is necessary to the lichen (they cease to exist when the intimacy is ruptured) with the leguminous plants the association is optional, and these plants may vegetate in the absence of their copartners, the bacteria and the fungi. From the point of view of nitrogenous nutrition the autogamous plants and the confederate plants conduct their operations in widely different manners.

*First.* Autogamous plants. These plants comprise all the green vegetables, excepting the leguminous and humiculus plants. They are incapable of nourishing themselves upon gaseous azote or nitrogen. In fact, if cereals are cultivated in well washed sand, free from azotic, organic or mineral matter, it is proved that when germination is terminated the young plants turns yellow and fade rapidly. They die of inanition.

Cultivated plants have then, at their disposition, but three sources of nitrogenous supply: organic nitrogen, ammoniacal nitrogen and nitric nitrogen. Is it a matter of indifference to them which of these forms is furnished? Results of observations made by Messrs. Lawes and Gilbert during the last forty years upon the cultures at Rothamsted will serve as an answer to the question. In a series of experiments made upon the utilization of nitrogen by cereals, they were treated each year with nitrogen added as fertilizer, and with nitrogen recovered after harvest. These results, as far as wheat is concerned, are herewith given:

| | | AZOTE IN 100. | |
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| AZOTIC FERTILIZER BY THE HECTARE AND BY THE YEAR. | KIL. | RECOVERED AFTER HARVEST. | LEFT IN THE SOIL. |
| Farm manure | 224 | 14.6 | 85.4 |
| Ammoniacal salts | 184 | 28.5 | 71.5 |
| ——— | 92 | 32.9 | 67.1 |
| Nitrate of soda | 92 | 45.3 | 54.7 |

It will be seen that the largest proportion of nitrates have

been appropriated by the cereals. This result proves that the nitrates represents the nitrogenous aliment *par excellence*; and that this nourishment is at once assimilated by the roots, without modification of any kind. Ammoniacal salts follow, with thirty per cent. of utilizable nitrogen, and lastly farm manure, with but fifteen per cent. Why these different results from among the same species, cultivated under the same conditions?

Nitric azote, or nitrogen, being the most easily absorbed by the roots, the other nitrogenous conditions will only be available as food after being previously transformed into nitrates. It has been said above, that all soils contain the means of this transformation, *i. e.*, that of microscopic organisms and ammoniacal and nitric fermentations, which successively change organic nitrogen into ammoniacal nitrogen, and the latter into nitrates. Ammoniacal salts having to undergo simply a nitrification, which is of very easy accomplishment for them, are, after the nitrates, the most readily utilized fertilizers. Farm manure and other azotic fertilizers should, previously to nitrification, undergo an ammoniacal fermentation. It will be understood that these modifications, requiring considerable time, cannot furnish to plants an immediate supply of assimilable food, which accounts for the small utilization of nitrogen from farm manure. These observations also show the importance of the organisms which exist in all soils. Incessantly active, they transform inert organic materials into assimilable aliment for the green plants. It is thus unnecessary to give the cultivated plants azotic nutriment in a mineral or organic condition, provided that in the latter case the activity of the microörganisms of the soil be sufficiently great for their needs. But should this activity be diminished or checked, the vegetation will languish, and the harvests become inadequate, even with abundant organic fertilizers.

It is often advisable to combine nitrates with organic fertilizers; this association furnishing an aliment directly available, and also permitting the plant to await the transformation of the organic materials by the ferments of the

soil. This plan produces vigorous plants capable of resistance to climatic variations and the inroads of parasites.

*Second.* Allogamous plants, or symbiotic associations. Two of these plant associations have acquired a considerable importance from an agricultural point of view; being on one side the symbiosis of leguminous roots with an alga, and on the other that of humiculous plants with a fungus.

*a.* Leguminous. It is well known that the greater number of the legums vegetate in poor soils incapable of nourishing other plants. The roots of these present special characteristics. If roots of trefoil, sainfoin or lucern be quickly plucked out, little tubercles will be noticed among the fibres, about the size of a grain of hempseed (*Fig. 11*); sometimes single and sometimes united in groups of three or four. In the tissues of these tubercles are always found many tiny organisms constituting a colorless alga from the bacterial group. This is the Bacteria radicicolus. It lives upon leguminous roots, forming the tubercles which protect it. The plant which harbors it is not injured by it, as the tubercles are only found in the very green and healthy fibres, and they occur in greater number only as the plant is more vigorous. On the other hand, they are invariably lacking in weak, stunted and discolored plants. Among legumes there are, then, two sorts of roots: one variety presenting the aspect of ordinary hairy roots; the others transformed into tubercles by the association of Bacteria radicicolus with the root tissues. By their normal roots legumes can nourish themselves, as do the autogamous plants, by means of nitric and ammoniacal nitrogen; but the presence of the tubercles gives them the faculty of drawing nutriment directly from the atmospheric nitrogen. In fact, if peas and lupines be cultivated in siliceous sand that is well washed and calcined, the plants turn yellow and fade, the washing having removed the nitrogenous nutriment, and the calcination having killed the organisms of the soil and destroyed the organic matters to such extent that the Bacteria radicicolus have not been able to establish themselves upon the roots. Improvement will follow the sowing of new bacteria. To do this the peas are allowed to remain

in the calcined sand, but are showered with an infusion obtained by diluting in water a quantity of earth taken from a garden of growing peas. This earth contains the bacteria which pass into the infusion. The result is surprising. Leaves which had yellowed and withered become freshly green, and the plant acquires great vigor, with abundant flowers and fruit. An examination of the roots after the plant's rejuvenation will reveal many parasitic tubercles. The washed and calcined earth having been despoiled of its mineral and organic nitrogen, the peas were obliged to depend upon atmospheric nitrogen; and this latter was only available and assimilable by means of the Bacteria radicicolus.

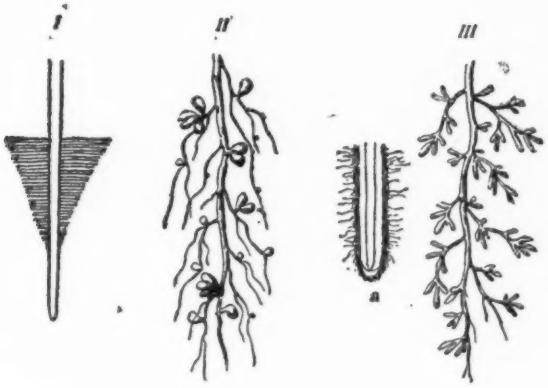
A very nice experiment confirms the above fact. In well-washed and calcined sand are sown a number of grains of lupine. Half of the grains may remain intact, and the other half be punctured with a needle which has been dipped in water containing tubercles from lupine roots. The puncture has the effect of inoculating the grains with Bacteria radicicolus. During the germination no difference is observed in the plants; but during the succeeding period, those plants which were not inoculated appear yellow and stunted, and finally die without having attained a height of over two or three inches; while the inoculated specimens become extremely vigorous, reaching a height of over two feet, with abundant flowers and fruit. Research has certainly demonstrated that it is gaseous nitrogen which is absorbed by the legumes in symbiotic rapport with the bacteria. The bacteria are alone capable of preparing the azotic gas, and by a series of chemical actions, not yet understood, they fabricate the nitrogenous aliment of the plant. The legumes are endowed with a double faculty. In the absence of bacteria they are nourished by the nitrates of the soil; but when assisted by bacteria they are fed with gaseous nitrogen and flourish vigorously in exhausted soils. Under ordinary circumstances arable soil contains Bacteria radicicolus in sufficient number. They exist without azotic gas when there are no legumes, and, therefore, it is not necessary to sow them. Cultivators have, however, observed that in planting peas,

lupines, etc., in new earth which has not grown legumes in many years, these plants do not thrive because of the lack of bacteria; and that this condition will disappear upon mixing with the impoverished earth soil taken from another field where there are thrifty peas and lupines. After a few days the sickly vegetables will become healthy, and thereafter it will not be necessary to add azotic fertilizer to the growing legumes.

*Third.* Mycorhiza. The second example of allogamous plants occurs in forest trees and their undergrowth. The soil of forests is entirely different from that of cultivated ground, in its abundant organic detritus, which forms the black earth known as mould; and also in its absence of nitrates, organic matter not being favorable to nitrification. The vegetation of humiculus plants thus takes place under especial conditions, and if we examine their roots we shall see that they also present striking peculiarities. If the roots of forest beech, pine or oak trees be suddenly plucked up, it will be seen that they bear numerous short radicles, which differ from the normal roots in the absence of hairy absorbents (*Fig. 111*). Their surface is sheathed with a felting of mycelien filaments adhering closely to the radicle (*Fig. 111 a*). On the inner side of this sheath the filaments are detached at intervals and penetrate the root tissues. Those which detach themselves from the exterior surface of the covering to enter the soil, often occur in such great abundance that they simulate the absorbent hairs. The fungus which envelops the radicles in this way is not a parasite, inasmuch as these formations are found upon healthy and vigorous trees. It is simply a reciprocal benefit, designated under the name of mycorhiza. Abandoning the idea of parasitism, what rôle is played by mycorhiza in the nutrition of trees? Experiments furnish a reply to this question. A first series of trials upon the beech showed that in calcined sand, with the addition of mineral fertilizer, but despoiled of organic compounds, and no mycorhiza, it remained stunted or died outright; but other growths made at the same time in pots containing forest earth were very vigorous. The pine furnished similar re-

sults. Earth was chosen from a pine forest containing the fungi which produce micorhiza. This earth was divided into twelve pots, each having received a little pine seed. Before the sowing eight of the pots were exposed to the action of water vapor at 212°, to kill all living organisms, and especially the mycorhiza fungi. After germination no difference was observed in the plants, but the following year those in the non-sterilized pots were far more vigorous than those in the sterilized pots. Two years after the sowing the difference was striking. The non-sterilized cultures exhibited plants six inches in height, having long needles of a fine green color. The sterilized cultures presented a wretched appearance, the plants being but two inches high, with short needles of yellowish green, and many of them were faded and dead. Examination of the roots showed that in the non-sterilized earth they had developed numbers of mycorhiza, and the soil was filled with mycelien filaments, forming flakes similar to those seen in rich forest mould. In the sterilized cultures the radicles were of slight development, the few branchlets having formed but meagre radicles, destitute of mycelien filaments, but having developed many short radicle hairs. Thus a vigorous growth of young pine plants coincides with the formation of numberless mycorhiza, whilst a stunted growth corresponds with the absence of these formations; and it is known that the conifers and the cupulifers (beech, oak, etc.) are so closely dependent upon effecting a symbiotic condition of their roots with fungi that they are incapable of nourishing themselves as other plants do, without that coöperation. The mycorhiza absorb certain organic substances, and from them evolve azotic aliments which are used in common; one part serving for their own nourishment, the other being utilized by the tree to which they are attached. It appears that the nitrogenous combinations of fungus furnish the principal source of the nitrogen absorbed in the first place by the fungi, and afterward by the trees whose roots have entered into dependent symbiotic relations with the subterranean mycelium. It is thus an established

fact that the mycorhiza are as important to the humiculus plants as the radicle tubercles are to the legumes. In each case they serve to attract and adapt atmospheric nitrogen into assimilable nutriment.



## WHAT IS GOD?

By Captain R. Kelso Carter.

This monograph is only intended for thinkers, for those who can and will dare to question for themselves. All others must pass it by, for it will be unintelligible to them.

The question in the above heading is not asked in the ordinary way, nor will the answer be sought along the channeled grooves of the doxies. There are new fields for thought, and fresh conquests for the daring thinker. While it is conceded that a being of superior order can, in the nature of things, never be fully comprehended by an inferior, yet the latter need not be unnecessarily limited as to his lines of investigation or definitions, but may dare to sweep the whole possible horizon scanned by his mentality. If, in our search after ultimate causation, we are to stop sooner or later with a name, a word, we might as well stop there in the beginning. Mere skilful arrangements of words is not explanation. Foolishness always sounds better in a foreign tongue, there can be no doubt of that; but the thinker wants something more than a word for the terminus of his mental road. In this view it seems that the old accepted definition of God, while perhaps very good as a terse expression of His attributes, does not really touch the question at all. "God is a spirit, infinite, eternal, and unchangeable, in His being wisdom, power, holiness, justice, goodness and truth." It is all very well to learn that God is a spirit, and that He is, in His very being, the concentration of these wonderful attributes; but the thinker returns with the query, What is God? "A spirit?" Well, what is a spirit? I know what is meant by wisdom, goodness, truth, etc., but what is "a spirit?"

Here is evidently the point which the skilful arrangement of words covers and avoids. This, after all, is the real subject of inquiry. True, we always proceed to define the

unknown in terms of the known; but the definition given stops with the matter of character or attributes, and says not one word concerning the actual personality or nature of the "spirit" God. Resolutely and fearlessly therefore, being a thinker, I press the question, What is a spirit? What is God? May it not be possible at least to approximate more closely to the truth? Let us try a new way.

The human mind is so constituted that it naturally thinks through its previous experience. To actually step out of its experience and positively originate thought is often deemed impossible. Certainly it is very difficult. An inventor said to me once, "It is very hard to see what does not exist." A strong proof of which remark is afforded by the length of time passing before the invention of the lucifer match, when necessity, the so-called "mother of invention," had been loudly demanding it every time man cooked his dinner for five thousand years. We are surrounded, however, by many things which almost compel the mind to step over the narrow bounds of the experimental. Look at the great forces of light, heat, electricity. Look at gravitation. The mighty orbs wheel smoothly in their cycles, held and controlled by a giant whose strength passes the power of the imagination to conceive. What is it? A "force?" But what is a "force?" The thinker refuses to stop with a mere word. Do not attempt to "darken counsel with words without knowledge" by saying it is an "attraction." Do not even insist on resting with a "mode of motion." 'Tis but another word, that is all. What is a "mode of motion?" Follow it up; go as far as words can possibly carry you; use every known form of definition, and what have you? Just a word, only a word. A "bombardment of atoms" is no less a mere word than the original "force" with which we started. Remember "foolishness sounds better in an unknown tongue." Shall we give it up?

The thinker *can not* give it up. His mind presses on. But is he therefore compelled to make a leap in the dark and land on a vague, intangible, indefinable, misty "spirit?" Generally he has *tried* to land there, though very often the

footing has proved most insecure and unsatisfactory. To the daring mind there is something beyond. Let us see.

If I speak of a "personal" God or spirit, at once the mind grasps the notion of a form with legs and arms, possessed of and limited by five senses. Why? Because this is the extent of our experience. But hold. We have before us the congenitally blind and deaf. The one knows absolutely nothing of color, and the other knows nothing of sound; you may exhaust language in the praise of the rose-leaf tints, and he will say, "Ah, yes, you mean it is so very smooth and soft." You may tell the other of the wonders of orchestration, and he exclaims, "You mean it is like the rainbow." Absolutely a creature cannot *know* beyond his senses. Add another sense, and an entire continent of experience is at once thrown wide open to him. So I cannot hope to know the spirit—the God—as such, except the necessary sense be granted. But I may approximate in this way.

I will not say a "person," but a "being." A word, which in itself merely expresses that something is. I can think of a being without the appendages of form, limbs and other human characteristics, and at once much of the former limitations pass away. It becomes easy to conceive of this being in one place as well as another, in fact as everywhere. Holding the mind resolutely against the temptation to slip away into a mere "essence" or "ether," pervading space, the thought grasps a "being," with intelligence and power, as everywhere.

See that mighty angel of gravitation, standing in the sun, and holding in his hands the cords controlling the planets! Ah, how easily the mind runs off into the old grooves; here we are at once with the arms and legs of limited humanity. But look farther. Think of an angel, a force, a power, not confined to or centred in a human figure; a power extending throughout the stellar universe, the gossamer meshes of the giant of gravitation crossing and recrossing in inextricable confusion, yet always obedient to the laws of his being.

So another may represent the power of electricity, everywhere present with his mysterious attractions and repulsions,

his strange polarizations and flashing destructions, ready to act as soon as favorable conditions occur. And another can be imagined as the genius of heat, another of light, etc.; each one an angel, a mighty, ever-present force, standing sleeplessly on guard at the portal of his own particular sphere, waiting for opportunity to act. The angel of sound is everywhere present, but subject to the laws of his own special sphere and limited by his nature; and he stands waiting for anyone or anything to start the vibrations which open the portal of his powers. When that portal is opened, instantly he responds. He is the bondslave of those vibrations, those limitations and those laws; never sleeping, ever ready to answer to a touch.

The word "power" is perhaps a little broader than "being." Scripture speaks of Satan as the "prince (or chief) of the powers of the air," and elsewhere of angels as "holding the four winds," "holding plagues," and of "standing in the sun," and pouring out thence destructive force. Why limit the idea of an angel—a spirit—to a human-like figure? Why not accept the partial definition—a "power of the air?" Certainly it is more reasonable to accredit intelligence to these marvelous "powers."

"But such an idea grants omnipresence to a creature," exclaims some good "orthodox" friend. Not at all. Such an angel is indeed everywhere present, but present only in and for his own limited sphere of action. The angel of gravitation is everywhere, but always and only as that force. He is not present for, or in light, or heat, or electricity. Those are other spheres from which he is excluded. Omnipresence means much more than being in every place. It means presence in every place, with power for every opportunity, yes, with power to make all opportunity. It means presence in place, force, matter, action, reaction, thought, mind, spirit, in short, in everything.

Suppose, instead of a "personal devil," we say an "intelligent power." May we not thus conceive of the real "genius of evil," of the "evil one," or "the evil" of the Lord's prayer? The two terms are synonymous. But he is limited

to his sphere of evil. So I conceive of certain "angels," not as figures of men and women, but as belonging to another order of being, so different from ours as to lie almost entirely beyond present knowledge, just as a "fourth dimension in space," (if there be such) is outside our experience and comprehension, or as a new sense over and above our five senses, is yet in the future. Hence, I dimly see such a being as a great force of gravity, electricity, light or heat, or at least, as a bearer of those forces, which forces, in their real essence, proceed from the one great centre and circumference of all things. And this conception appears to me vastly more lofty than a meaningless "mode of motion," or a vague name that signifies nothing to the thinking mind.

In this view then, the Spirit—God—is the Being of beings, the Infinite Power of powers; not limited by a human figure, nor circumscribed by any one angelic sphere, but present everywhere and in everything, as the centre, origin, "radiant point" of all powers. In the very nature of things, such a Spirit-God can only be *known* to His creatures through and in the special sphere of each. The angel of gravitation knows Him in and through the workings of that mighty power. The sword of the electric angel cuts wide and clear the pathway of knowledge comprehensible to that wondrous being. The angel of light knows Him in the trillion, trembling beam. "God is Light." But we cannot reverse those words and say "Light is God;" that would be Pantheism. Light is of God—a different matter. But we, how can we *know* Him? We have not the avenues of the mighty angel forces. True; but we have our senses, and science whispers of the possibilities of others in the occult realms beyond. We are sure others exist, though we can not yet control them. We can know Him, not as a "person" with human figure and limitations, but as a force, a power, yes the power of all good, making all possible opportunities, and sleeplessly standing at the portals, ready to act instantly as we consent to utilize or open them.

But if we are to know Him more than that, in the scientific nature of the case there becomes necessary a condensed

manifestation of Himself, in such form and manner as to come within the closer range of our powers. Hence, whether true or false, the words are scientifically consistent, "God was in Christ, reconciling all things unto Himself." In this manifestation of Himself He reconciled or acquainted all things with Himself, or, at least, made that possible. Hence, again, it is scientific, when we read the declaration concerning Christ, "In whom I am well pleased." Not with whom, but "in whom." Pleased that, in this manifestation, the great Spirit-God could acquaint His creatures with Himself.

Finally, "when He bringeth in the first-begotten into the world, He said, 'Let all the angels of God worship Him.'" (Be subject to Him.) Notice that "of the angels He saith, who maketh His angels spirits, and His ministers a flame of fire," and that these angels are "ministering spirits, *sent forth* to minister." Hence, in proper scientific sequence, all the angels, all the great genii of the "forces of nature," the angels of the deep, light, heat, electricity, gravity, all worshiped and obeyed Him. Hence, Jesus commanded the light, and shone forth on the mount of transfiguration, and moved unseen from the midst of the murderous crowd. He set aside cohesion and passed through doors. He paralyzed gravity, and walked upon the waters. He warmed the dead into life from the chill of the grave. He descended into the fires of the "nether parts of the earth," and "taking captivity captive," ascended to God—to the infinite, all-including Spirit from whom He came, having fulfilled His mission of revealing, manifesting and explaining to the creature man what God is.

## A COMING REVOLUTION IN POWER.

By Lieut. F. Jarvis Patten.

Among the radical changes that the nineteenth century has brought to pass, none are so striking and eventful in character as those of the past twenty-five years, and the prediction is safe that the few years of this century that remain will bring equally startling changes in at least two of the industrial and economical applications of power. Reference is had to horseless vehicle now close at hand, and the yet vastly broader and more sweeping revolution that will be brought about by the derivation of power for industrial purposes generally from some form of combustible gas instead of coal.

The application of electricity to lighting, though brilliantly successful, has thus far nevertheless produced only a costly, and in some sense a luxurious illuminant, and is still far from being a commercial substitute for gas as at first anticipated.

Electric light for interiors, though comparatively common, is seldom entirely independent of gas. The people have been educated to it, and now it must be had because of the pleasing decorative effects it produces, and no public building or place of entertainment is regarded as complete without it. Such is the lesson of habit once taught even to the masses. Our avenues lined with arc lights of over a thousand candle power, are not to be compared with the same streets as lit by gas some ten or fifteen years ago. The streets are better and the city is better for the new lights, but no enthusiast will contend for a moment that it is cheaper than gas; it costs more, but then it is worth much more, therefore we must have it.

With the rapid strides of science and the perfection of every branch of the electric lighting art the new illuminant has not yet invaded the dwelling to any appreciable extent. As far as domestic lighting is concerned the field of gas is

still practically undisturbed, and in the household the electric light is indeed a luxury.

Engineers and inventors are none of them sanguine as to what the solution of this next problem will be, nevertheless there are now horizon indications that point quite clearly how a great change shall in the near future come to pass. We shall continue doubtless for years to hear how this inventor or that pseudo-scientist is devoting his energies to the discovery of a method of getting electricity directly from coal. This story has been and probably always will be one of those fads that the newspaper writer will continue to harp upon, and these visionary undertakings become fads in fact, simply because they are never accomplished. It is deferential to the existing wonders of scientific achievement to admit that nothing is impossible, yet in the nature of things it would seem that some things must be either actually impossible or inconsistent with the existing order of things, which amounts to the same thing.

Science can now derive electricity directly from coal; nature has made no deeply hidden secret of such process, but the process is neither economical nor practical, and there is evidence enough that nature does not intend that it ever shall be. Scientists are not looking in this direction seriously for the next advance; it is only the charlatan and they whose aim it is to hoodwink the public who look for or pretend to find the cheap electric light of the future in the derivation of electricity directly from coal.

Great changes in scientific advance and radical departures of every kind are always the outcome of a steady, though maybe a comparatively, unobserved growth—a growth that has generally had some obstacle in its path, which, suddenly removed, a wide and entirely new field of application is immediately opened up.

The advent of the modern electric light itself is in fact a pertinent illustration of this law of advance. Thus, the arc light was well known and easily enough produced in the forties, but its costly production, through the consumption or burning of zinc instead of coal, diverted attention from

the subject; no other more economical way to obtain an electric current had then been discovered, so the arc light was literally in the shade for a quarter of a century. The discovery of the direct current dynamo, however, removed at once the chief obstacle that stood in the way of a comparatively cheap electric light; one at least that can be had from the burning of coal instead of zinc, thus reducing its cost in the proportion of about twenty-five to one.

It is fair to presume that the obstacle that stands in the way of the cheaper electric light for the household will be surmounted at an early day by the quiet march of progress that is now going on, and which is destined in the nature of things to remove the barriers to all industrial advance as our needs require.

It is generally the case that one line of advance in scientific research or industrial developement affords the means of perfecting another, and this we shall doubtless find the case in this instance. The chief and only obstacle that now stands in the way of cheap and universal electric light, as well as electric power, is the apparently unnecessary high cost of electricity, and this, barring its extraction directly from coal, is due to the roundabout way in which we are compelled to get it from coal, through the agency of the steam engine and the dynamo.

The latter is a highly efficient engine, more, in fact, than ninety per cent. of what is given it in mechanical power by the driving engine being returned in electric current. No complaint can be made of an efficiency like that. Indeed, the dynamo is the only engine with which modern science may feel thoroughly satisfied.

The trouble lies in the old and trusted steam engine, with its complex processes of first burning coal on a grate to heat water in a boiler, and then using the expansive force of the evaporated water to produce mechanical motion, and this in a comparatively clumsy way; for it is generally first made reciprocating, and this with more waste of energy is converted to the rotary form required by the dynamo.

The steam engine has done yeoman's service, but science

can only regard a machine, or engine, as far from perfect that only yields an entire efficiency of about fifteen per cent. from the coal pile to the dynamo. Indeed, this estimate is very high, and can only apply to large triple-expansion engines.

It is upon this engine that the attack of industrial progress is now being directed, and the attack consists simply in the perfection of the so-called "internal combustion engine," commonly spoken of as the gas engine, the gasoline, or petroleum engine.

This type of engine has had scarcely a quarter of a century of developement, but the recent strides that have been made bid fair to swing this developement into line as one of the most consequential of this century of industrial progress.

The theory of the internal combustion engine is simply this, in general terms: Gas, under pressure, taken either from a reservoir, or else derived in the machine, from gasoline or crude petroleum, is admitted to a working chamber, corresponding to the cylinder of a steam engine, and there exploded by ignition, the expanding gases doing work on the reciprocating or moving part. The principle is essentially the same as in a gun, or "ballistic" engine, as it is sometimes called, where the rapidly expanding gases of the exploded powder expend their energy by doing work upon the moving projectile. It is the gun or ballistic principle applied to continuous mechanical motion so as to obtain a controllable power.

The perfection of such a machine would evidently do away with several of the wasteful processes that remain apparently necessary in the steam engine. Thus the fire under the boiler on the grate is avoided, the useless heat radiation of which is many times greater than the amount of heat applied to the water in the boiler. The smoke and ash losses are almost wholly avoided; the unnecessary heating of water and the useless boiler radiation to the surrounding air is all done away with; the reciprocating machinery will also doubtless soon be discarded, and the exploding gases will

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act directly on a rotary part as in the case of the modern steam turbine.

These various savings, all of vast significance, should combine to produce an engine of something nearer sixty per cent. efficiency than fifteen per cent., as in the case of the steam engine. What then may we expect as a result of the early development of the gas engine to a state of approximate perfection? This development will soon come, and its meaning in the broadest sense is cheap power—power for everything at about one-third its present cost. Nothing could be more important than this in the entire industrial world; indeed, the revolution such an advance would produce is quite incalculable in its far-reaching results.

It would mean not only that we would have electricity cheap enough for household use as far as lighting is concerned, but further, that having a fireless and smokeless engine of small dimensions that would require no attendant, the dwelling could then have its own gas engine-driven electric generator, and in fact the modern dwelling could then be equipped with light, power, elevator and water service in much the same manner as our office buildings now are in large cities.

This, however, is but a minor incident and feature of the coming age of gas. The greater revolution will be in the broader industrial applications of power, not only in factories, but also to railroads and the long distance transmission of power by electricity.

The present consumption of coal by our railroads in the United States is something enormous. If we can get, say three times the amount of power from the same weight of hydrocarbon in the gaseous form, it would evidently be profitable to distill the coal instead of burning it, and then burn the gas in the "internal combustion" engine.

In this way power in large units can be delivered cheap compared with its present rate, and as ninety per cent. of the power can be converted into electricity for any use by the modern dynamos, we have then here the evident solution of the long distance transmission of power by cheap elec-

tricity for any desired use, and we become independent of the waterfall heretofore regarded as the only promise held out to us of cheap electricity.

As for the railroads, their engines will either be electric locomotives, the practical and economical working of which is already an accomplished fact, or the locomotives themselves will be gas engines driven by compressed gas in tanks filled at five or six thousand pounds pressure to the square inch.

This view of the coming revolution is far from being visionary, is barely prophetic; indeed, the change has already begun in a small way in this country, though in Europe gas engines have developed rapidly, and such engines of three hundred horse power are not uncommon. In this way only can the dread of our coal beds giving out be met, first by prolonging several times the life or power giving value of the coal, and eventually there will doubtless come as an attendant upon such a revolution other new and probably much cheaper processes of making some hydrocarbon gas, independently of coal. This would leave the products of our coal fields a very cheap commodity, for the fire grate of the household and the cooking range alone.

That such a prediction is far from visionary in character is already evidenced by the alleged recently-discovered process of obtaining acetylene gas, one of the best illuminating gases, by a process that is cheap and entirely independent of the use of coal. The advent of cheap gas now has a broader meaning; it means in all—cheap power for everything, cheap electricity, and the doom of the steam engine early in the coming century.

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## WHY GOLD GOES ABROAD.[1]

By A. C. Fisk.

The necessity for issuing coin bonds, or any bonds, especially in times of peace, may well be questioned by the thoughtful people of this country. Producing nearly $100,000,000 worth of the precious metals annually, with commodity exports reaching an annual average of nearly $800,000,000, our money still goes abroad, and the nation, state, county and municipal governments, corporations and individuals are constantly issuing interest-bearing obligations which are sold abroad. These are facts calculated to arouse in the mind of the careful business man a suspicion that something is wrong in our economic conditions. Why should a great producing nation borrow money? The answer is simple. Competing nations fashion our monetary system. If we had sufficient money, there would be no occasion to borrow. If even the money which the Government claims to be in existence in this country were really in circulation, there would be little occasion to borrow.

Where is this money? The Treasury Report for 1894 states the money of all kinds in existence in the United States at the close of that fiscal year as amounting to $2,420,434,781. There was in the Treasury at that date $759,626,073, leaving in circulation, according to the report, $1,660,808,708. If we count our population at seventy million, this would give a per capita circulation of $23.70. The Secretary does not presume to tell us where this money, which he says is "in circulation," is to be found. He

[1] For a more detailed treatment of this question in its relations to bond issues, currency contraction, and the demonetization of silver and greenbacks, than is possible in the limits of a review article, the reader is referred to the author's series of works on the currency question, "Statesmen Three," of which No. 1 has just been published in 12mo. paper, illustrated, pp. 224; price, 25 cents. Statesman Publishing Company, 63 Fifth avenue, New York.

assumes that because this money has been issued and is not now in the Treasury, it must be in circulation among the people. The amount held as reserves by private and savings banks and trust companies cannot be accurately given, as the laws governing bank reserves are not the same in all the States. There was, according to the report of the Comptroller of the Currency for 1894, $2,973,414,101 deposited in banks other than national banks. A fair estimate of the amount required by law to be held as reserves by state institutions would be fifteen per cent., which would give us a total of $446,012,115. This is only one of several items which should be deducted from the total amount of money issued, in order to arrive at the actual monetary circulation, but which the Comptroller of the Currency ignores in his report. It will conduce to a clear understanding of the actual situation if we state these items in tabulated order:

| | |
|---|---|
| National Bank reserves (according to report of the Comptroller of the Currency, May 4th, 1894) | $452,103,214 |
| Reserves of banks other than national | 446,012,115 |
| Lawful money deposited with the Treasurer to secure national bank notes | 23,706,669 |
| Government deposits in national banks | 14,314,529 |
| Currency in the Treasury (Secretary's Report for 1895) | 796,638,947 |
| Deposited with the various States under Act of June 23, 1836 (Comptroller's report, p. 27) | 28,101,644 |
| Estimated loss of gold coin | 260,000,000 |
| Estimated loss of silver coin | 35,000,000 |
| Estimated loss of greenbacks | 90,000,000 |
| Estimated loss of fractional currency | 6,916,690 |
| Loss of national bank notes (10 per cent.) | 20,685,478 |
| Gold exports in excess of imports for 1895 | 30,117,376 |
| Silver exports in excess of imports for 1895 | 27,631,789 |
| Total unavailable for circulation | $2,231,228,451 |

Deducting this total from $2,420,434,781, the aggregate amount of money "coined or issued," according to the Comptroller's report, we find the actual amount of currency in circulation to be $189,206,330, or a per capita circulation of $2.70.

The question may be asked how I arrive at the amount of paper money lost and destroyed. Mint Director Kimball, in his report for 1885, states that the amount carried on the books of the Government at that time was erroneous, and that not to exceed $100,000,000 of gold not in the Treasury could be found. Senators Sherman and Stewart and other members of Congress have stated in public debate that no deduction had ever been made in the Treasury reports for coined money used in the arts or lost, nor for the paper money which had been lost, burned or otherwise destroyed. Mint Director Leech, in his report for 1889, says:

"The elements of uncertainty in these official tables have been: first, the actual consumption of coin in the industrial arts, and, second, the amount of coin which finds its way out of the country without being recorded."

The Secretary of the Treasury gives the amount of gold coin and bullion in existence in this country as $627,293,201. From this let us deduct:

| | |
|---|---|
| Amount given as in the banks of every description | $133,398,786 |
| Estimated amount destroyed, used in the arts and unrecorded exports | 260,000,000 |
| Amount in the Treasury | 131,316,471 |
| Total | $524,715,257 |

If we deduct this sum from the amount of gold which the Secretary says is in existence, we have in circulation among the people $102,577,944. It would be difficult to prove that there is even this amount of gold coin in actual circulation among the people. With but $2.70 per capita of money of all kinds in circulation, it is no wonder we are compelled to borrow money.

### WHERE DOES OUR MONEY GO?

The answer to this question will be found in a careful examination and analysis of the government reports of exports and imports. We find that the figures for the years 1860–1869 show a balance of trade against this country of $752,557,609. Adding to this $945,304,279, the amount of excess of exports over imports of gold and silver for the years

1864–1894, we get a total of $1,697,861,888. Deducting this amount from $1,784,526,973, the balance of trade in our favor for the years 1870–1895, leaves an apparent balance in our favor of $86,665,085, or an annual average for the thirty-four years of $2,554,826.

As a matter of fact the balance of trade is really largely against us at this time, has been so for many years, and is constantly increasing. Every statesman of any eminence in the history of the last three hundred years has laid it down as an axiom that the value of property is determined by the volume of money in circulation and its proportion to the volume of trade transactions. The contraction of the circulating medium, effected in the interests of the creditor class, has greatly decreased the value of the commodities which go to pay our debts. Our ability to pay has been decreased more than one-half, while interest, payments on account of principal and other fixed charges are steadily increasing.

By maintaining a standard of money, the purchasing value of which is twice as great as that of countries with which we have to compete, we have practically ruined our manufacturing and agricultural industries. The result is that debt of all kinds is constantly piling up against this country. Poor's Manual for 1895 gives the indebtedness of the railroads of the United States—stocks, bonds and other interest-bearing obligations—at $11,565,600,207.

We may sum up these debts in the following estimate:

| | |
|---|---|
| Railroad stocks, bonds, etc | $11,565,600,207 |
| National, State, County, Municipal, Water and School bonds | 2,250,000,000 |
| Mortgages on farms and homes | 7,000,000,000 |
| Liabilities of commercial firms | 15,000,000,000 |
| Liabilities of trusts and individuals, not included in any of the above | 14,000,000,000 |
| Total | $49,815,600,207 |

The Interstate Commerce Commission reports give the gross earnings of the railroads for the year ending June 30th, 1893, as $1,220,751,874, and net earnings as $392,836,574, the latter being paid in interest and dividends. About two-thirds of this sum, or say $260,000,000, goes abroad.

Of the railroad debt, $5,075,629,070, is represented by stocks common and preferred, and, while not a fixed charge, dividends amounting to more than $100,000,000 were paid on these stocks in 1893. Deducting this item, we still have a total indebtedness of $44,739,971,137. It is safe to say that, exclusive of both the stocks and bonds of our railroads, not less than $5,000,000,000 of the remaining debt in this country is held abroad. At five per cent. this would make our annual interest charges $250,000,000. The income from breweries, paper mills, coal, iron, copper, silver and gold mines, lands, buildings and dividends on stock of American newspapers and other enterprises owned abroad amount to about $200,000,000 more.

Our foreign carrying trade is constantly falling off. It is now completely under foreign control. We are helpless in our passivity. No other nation on the globe has experienced so swift and complete a decadence in commercial and financial power. Foreign statesmen talk of the cheapness of our silver, and plan to capture all our silver and gold, to say nothing of other products. We pay to foreign marine for freightage, postal service and ocean passenger traffic, and for commissions to foreign merchants on these items and for the use of foreign capital in banking, insurance, etc., in all not less than $300,000,000. American tourists in Europe take out of the country $100,000,000 annually. To recapitulate:

| | |
|---|---|
| Interest and dividends on railroad bonds and stocks | $250,000,000 |
| Interest on $5,000,000,000 other securities | 250,000,000 |
| Foreign profits on investments in American banks, breweries, newspapers, etc. | 200,000,000 |
| Foreign marine freight, commissions, etc | 300,000,000 |
| Amount taken by American tourists in Europe | 100,000,000 |
| Total | $1,110,000,000 |

This amount represents the real balance of trade against this country, which must be paid in gold, or by issuing new obligations payable in gold.

Foreign capitalists have lulled our statesmen to sleep in the belief that the balance of trade is in our favor, and

against European countries. The reverse is the truth of the matter.

Let us take the United Kingdom. The balance of trade in commodities is against that country, and increasingly so year after year, being now about $650,000,000. Let us, however, strike the real balance:

| | |
|---|---|
| Great Britain holds at least $12,000,000,000 of the world's debt, on which she draws interest at the rate of five per cent., say as an average, or | $600,000,000 |
| Her profits on English ships in foreign waters, on commissions, insurance, banks, etc., is | 300,000,000 |
| Investments in foreign newspapers, breweries, banks, etc. | 200,000,000 |
| Total | $1,100,000,000 |

Deducting $650,000,000, the adverse balance of trade in commodities, from this enormous total of income from foreign sources, we find the actual balance of trade in favor of the British Isles to be $450,000,000 annually.

Similar computations in regard to German and French trade and investments would show like results. These conditions have been brought about by the activity of foreign money lenders in controlling the monetary legislation of both continents. That this policy and the state of things consequent on it is no more favorable to the *people* of Europe than it is to the people of the United States, should be made clear and thoroughly understood. It is a policy which works to the advantage of the usurers alone. They maintain in the the United States a two hundred cent dollar with which debts must be paid; but the producers of commodities are compelled to accept fifty cents on the dollar. This has ruined the merchant, manufacturer and farmer in Europe as well as in the United States.

The fifty per cent. tariff in favor of the manufacturers of the United States cannot save them from the effects of the one hundred per cent. advantage which the par of exchange gives the manufacturers in silver basis countries. Were exchange at par in countries with which we compete in manufacturing, and in wheat and cotton growing, the case would be different; but we are compelled to compete with a handi-

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cap of one hundred per cent. in all silver basis countries. Suppose this to be a tea-producing country, and that a certain grade of tea is worth in China or Japan one dollar a pound. The Chinese or Japanese importer, by buying exchange on the United States or Europe, gets the tea at fifty cents on the dollar. The Chinese or Japanese tea-grower receives the same price he received twenty years ago; but as it costs the importer only fifty cents, unless the American tea-grower can produce this dollar grade of tea and sell it for fifty cents, he is forced out of the market. The same reasoning applies to wheat, cotton and every other article of export, whether it be raw material or manufactured product.

As the commodity price of silver declines, exchange in silver basis countries on gold standard countries advances, and to the extent of this advance the producers of commodities for export are protected by the exchange tariff. The exports of wheat from India, since the decline in the price of silver, have increased more than one thousand per cent., and the increase in the shipments of yarn from that country has been two thousand three hundred and sixty-four per cent. since 1876. Producers of articles for export in gold standard countries cannot compete with producers in silver basis countries.

The Statistical Abstract of the United Kingdom shows that the manufacturing establishments of that country, with rare exceptions, are losing money. The same is true in all gold standard countries. The protective tariff on manufactured articles in favor of the manufacturers of this country does not counteract the exchange tariff against us and in favor of silver basis countries. Our high tariff, although an excessive burden to the consumer, only protects the manufacturer to the point of a bare living. The gold basis is beneficial to the money lender alone. It is ruin to every honest industry. It is maintained by this nation at the dictation of the money power—the banded usurers of the world—and at the sacrifice of every principle of equity and justice.

The commodity imports of the United Kingdom, France and Germany, are largely in excess of their exports, because,

in addition to their excessive income from foreign investments in the shape of fixed annuities, they purchase from silver basis countries at fifty cents on the dollar and sell to those countries at two hundred cents on the dollar. As they purchase more than they sell, their imports are actually more, profitable to them than their exports.

It is very different with the countries whose commodity exports exceed their commodity imports. China, Japan, Mexico and other silver basis countries whose commodity exports exceed their commodity imports have learned this lesson, but the United States has not. If this country were to go to a silver basis, or, more correctly speaking, to a one hundred cent dollar basis, every legitimate business would be benefited to that extent. No economist will deny that prices would increase to the extent of the premium on gold, and that debts would decrease to the same extent. The usurer alone would suffer.

Are our law-makers legislating in the interest of the sixty-five millions of our producing population, or in that of the five million non-producing usurers? Who will answer?

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## THE ELECTROPOISE AND NERVE FORCE.

By Beverley Oliver Kinnear, M. D.

What nerve force is has puzzled physiologists from time immemorial. That this mystery has been at last solved, we are convinced.

A series of experiments are about to take place, which, it is believed, will satisfactorily prove the hypothesis advanced in this paper. During the past fourteen years our chief study has been the circulation of the blood in diseased conditions, the action of the blood upon the nerve centres, and the effect induced throughout the body by hyperæmia and anæmia of these central nerve cells. After making personally about eight thousand cold and hot applications over the spinal cord and sympathetic ganglia, we have arrived at the conclusion that every form of organic disease delineates a corresponding perturbation in central nerve cells, and that the so-called "functional diseases," are really due to an abnormal circulation within the nerve centres. It is considered a fact to-day by leading physiologists and clinical observers, that metabolic or tissue changes are largely under the control of the nervous system. We believe they are completely so, and that the healthy action of all organs, muscles, tissues and bones, depend upon a normal circulation within central nerve cells. Let us endeavor to prove our conclusions.

There are five sets of nerves recognized, *viz* :—those of sensation, motion, vaso-motor, glandular and trophic, or nerves which regulate nutrition, and which practically come under the head of vaso-motor, because nerves which control the nutrition of the whole system must be divided into those which expand and those which contract the arteries.

Again, nerves which expand and contract the arteries in glands, may be practically called "trophic or nutritive," as these organs have to do with assimilation, secretion and excretion. It is well recognized that the chief function of the sympathetic ganglia, or knots of nerve tissue running in

a chain upon each side of the vertebral bodies, is to contract the arteries. When stimulated by galvanism, the arteries controlled by the ganglion or ganglia acted upon, lessen in calibre, so that the temperature of the body where these nerves terminate, falls, and nutrition is decreased. On the contrary, if the sympathetic nerve be severed, an increased temperature and nutrition result.

The only reasonable conclusion we can arrive at from this last effect is, that when the sympathetic nerve is cut, the vaso-dilator nerve, terminating in the tissue cells, has lost the natural check to its hyper-action, and the sole development which can follow will be an undue nutrition and rise of temperature, owing to a sudden expansion of the arterioles, with rapid circulation through the dilated vessels, this again attributable to the excitement of the tissue cell; thereby inducing more speedy chemical changes (with increased heat of course) between the blood and the tissue cells.

The conclusion to be drawn from these experiments is that the circulation of the blood in a healthy individual is normal in all parts of the body, therefore the circulation within the nerve cells, contracting arteries and those dilating them is equal. If, however, the balance of the circulation within these centres be upset, we will then, at some point distant from the centre, behold manifestations of disease.

Thus, if the sympathetic ganglia receive a greater access of blood than normal, the outcome will be a generally contracted circulation; with a weakening of the skeletal muscles from lack of their usual blood supply, a feeble pulse, a cool or cold body or extremities, with impaired digestion and general excitement of the brain and spinal cord, from a confinement of the blood within a limited area. Thus in nearly all cases of the so-called neurasthenia, which we believe should be called neurosthenia, we have mental excitement or depression, motor excitements, general hyperæthesia and a tendency to congestions of internal organs.

And these conditions we believe to be wholly due to the forcing of the blood in abnormal amount into the internal organs and nervous system by the general contraction of

blood vessels in the extremities, and upon the surface of the body. This contraction arises, as we have shown, by *over action* of sympathetic nerve centres, and thus by an excess of nerve force, and not from a lack of it.

"Microscopically, nerves have been traced directly to the nuclei of the gland cells in the salivary glands, by Pflüger and Boll; by Letzerich, to the gland cells in the testicle." They have also been traced to the cells in the sweat glands and kidneys.

Dr. Klein has traced sympathetic nerve-fibres to the capillary blood vessels.[1] Dr. Claude Bernard demonstrated that, after the section of the lingual nerve, galvanization of the peripheral end of the severed nerve "caused the *vessels of the tongue* and of the sub-maxillary gland to dilate, and the gland itself to take on functional activity."

Thereupon Dr. Brown-Séquard, having verified this experiment, declared: "We have said that there are two modes of action of the nervous system upon the production of the phenomena of nutrition and secretion. By one of these actions the nervous system determines an increase in the attraction of blood by the living tissues, and in this case the phenomena are accompanied by a dilatation of the blood-vessels; while the reverse exists when the nervous system, instead of acting upon the parenchyma of the tissues, acts upon the walls of the blood-vessels and produces a contraction. In the first case, the quantity of blood passing through the part on which the nervous system has acted is increased, while in the second case it is diminished; in the first case the secretions are increased, in the second diminished; in the first case nutrition is more active and there is a tendency to hypertrophy and an augmentation of the vital properties of the nerves and muscles; in the second case nutrition is not active and there is a tendency to atrophy of nerves and muscles; lastly, in the first case there is an augmentation of temperature, while in the second there is diminution. There

[1] Essay on "Hay Fever, a Nervous Disease," and its treatment by Spinal Ice Bags. Read at the Annual Meeting of the United States Hay Fever Association, held in Bethlehem, N. H., by B. O. Kinnear, M. D., August 26th, 1890.

is, therefore, the most complete difference between these two nervous influences." [1]

Here we see that this great physiologist fully endorses our position. That every tissue cell in every tissue and organ is supplied by a nerve terminal, which, when stimulated, will dilate the capillary blood-vessels, increase temperature, and cause active metabolic or molecular changes in the tissues. It is now a well-established reality that cold water or ice over the spine in rubber bags, broad enough to cover the sympathetic ganglia, if applied in cases of chill (such as malarial chill), or in people suffering from cold extremities, with all the attendant evils related thereto, will expel the excess of blood from the sympathetic central masses, and, as a result, the arterioles will generally dilate, the body and extremities will become warm, the nutrition will be increased, and through a series of such applications the patients will regain their original vitality and health without the aid of any drug.

Conversely, when heat is used over these contractile arterial centres, inflammations, congestions and hemorrhages may be speedily subdued.

The nerve force supplied by the vaso-dilator nerves may be called *positive* nerve force, because it causes the tissues to act vigorously, while the action of the sympathetic ganglia may be named negative nerve force, for the reason that it induces a feeble nutrition when they function powerfully. By heat and cold over the spine, we have saved some lives, and cured many sick persons; but by this method, we suspected, but never *discovered*, what nerve force was.

That nerve force is generated in a nerve centre, and by the agent (the blood) which carries nutrition to all parts of the body, we believe that all investigators will allow, just as we allow that the electric cell generates a current of electricity by chemical changes induced by different substances when in contact.

We have now, however, we believe, discovered what nerve force is, by the action of the ELECTROPOISE when the

[1] "Mechanisms of Control in the Nervous System and Their Functions." Reprint from the *Alienist and Neurologist*, April, 1886.

plate of the instrument is in contact with the body of man or animal.

This instrument consists of a cylinder filled with finely ground graphite and sulphur, connected by a silk cord inclosing fine copper wires, with a plate which is secured to the wrist or ankle; or it may be placed over any part of the body which is the seat of pain, swelling or inflammation.

When the cylinder or polarizer is made cold, and the plate is warmed, a current of thermal force is generated of the strength of five millionths of an ampere, with a resistance of one one-thousandth of a volt. The instrument was thoroughly tested by an expert electrician in Washington.

The argument has been advanced that because there is but one wire and no *visible* circuit of current, it is impossible that this thermal force, acknowledged to be generated under the proper conditions, can enter the body of man or animal and produce any effect whatever.

In the first place, do the facts bear out this conclusion?

Decidedly not.

When the polarizer is made cold and the plate is placed upon the warm surface of the body, there is one invariable effect, noted now by the writer several hundred times, *viz.*, that in tired people, chilly people, and neurasthenic people, the pulse becomes full and round, the hands and feet become warm, the respiration deepens, the nerves become quiet, the appetite increases, and general reinvigoration of mind and body result. In other words the twelve to eighteen pounds of blood in the adult, is made to flow to all parts of the system, with a consequent rise of temperature, increase of nutrition, more energetic and natural secretive and excretive functions, and a much greater absorbtion of oxygen by the lungs than before treatment. But this is precisely what the Chapman Ice Bag does, though in a more bungling and inefficient way.

Therefore, the thermal electrical force, to produce the effects it does upon the human body, must be carried by the sensory nerves to the spinal cord; reflected then upon nutritive nerve centres, carried along the nerves issuing from these

centres to every tissue cell in the body, stimulating these cells; thus dilating the arterioles everywhere in a normal way, and increasing nutrition in every tissue previously insufficiently supplied with blood.

If the Electropoise does act in this way (and it does), we have an agent which in acute forms of disease will act at once.

For example, take peritonitis. Here we have a tremendous afflux of blood to the membrane covering the bowels, with pain from pressure, a most active circulation and effusion into the peritoneal sac.

Apply the Electropoise powerfully, placing the cylinder on ice and covering the plate with a hot compress.

In the incipient stage of *any inflammation* the improvement will begin at once. Why? For the reason that this *positive nerve force*, entering the body and acting immediately upon all vaso-dilator nerves at the same time, causes the blood in excess in the inflamed area to *disperse from that locality*, because, under the thermal electrical force generated by the Electropoise, every tissue cell in the body *outside the bounds of the inflamed area is excited and dilating its own arteriole.*

This being so the excess must depart from the congested, hemorrhagic or inflamed part in order to supply the demand of all the tissues; and there is rapid relief to the pain, the temperature falls and the pulse moderates its speed. In several inflammatory disorders treated by the writer, relief has speedily been given and the sufferer's strength restored very quickly.

Place the cylinder of the Electropoise in *hot water* and apply the plate to the body, and, if used for a long enough period, a chill will follow.

We see, then, that in one case this thermal force acts only and always upon and through vaso-dilator nerves; in the other through the sympathetics. It follows that, if the foregoing be true, a form of electricity of low power, generated by connected hot and cold substances, enters the body and supplies a form of nerve action which always induces vigorous molecular nutritive changes in the body; and, contrary-

wise, if reversed, supplies a nerve action which weakens and exhausts the whole system; therefore, it appears to the writer that this thermal force can be neither more nor less than NERVE FORCE, and as we can now supply it ad libitum to sick persons, we can renew their vigor by restoring the *balance* of the general circulation as well as the balance between the nerves which contract the arteries and those which dilate them.

We believe the circuit is made, in using the Electropoise, from the patient's body through the *air* back to the polarizer, and we expect soon to prove it by a few not difficult experiments. Electricity by induction will carry messages thirty and forty feet through the air, and, as the water in which the polarizer is placed becomes medicated during the use of the instrument, we have, by that fact alone, strong reason to believe that the *return current through the air* is the cause of the chemical alteration in the water.

## THE MUSIC OF THE SPHERES.

By Mary Proctor.

"From harmony, from heavenly harmony,
This universal frame began:
From harmony to harmony
Through all the compass of the notes it ran,
The diapason closing full in man."

Dryden.

Amid the busy hum of life, let us pause awhile to note the grand harmony of nature's choir; the deep anthem of the mighty ocean, the soft whisperings of the leaves on the trees, or the plaintive rustle of the dead leaves at our feet. Listen to the joyful carol of the birds, the ripple of the waves, the thunder of the tempest, and the vesper hymn of the evening breeze, and do we not exclaim with Watts:

"Strange! that a harp of a thousand strings,
Should keep so long in tune."

With regard to the music of the spheres, Pythagoras, and some of his earliest disciples, taught that the stars and planets, during their revolutions, omitted musical sounds of various intensities, according to their distances from the earth, all of which, however, were supposed to be inaudible to men. The following is the account given of the supposed discovery of the harmonic numbers:

"It is stated that when passing near a forge one day, Pythagoras noticed that the hammers gave out very accurate musical concords. He had them weighed, and found that of those which sounded the octave, one weighed twice as much as the other; of those which made a perfect fifth, one weighed one-third more than the other, and in the case of a fourth, one-quarter more. After having tried the hammers, he took a string stretched with weights, and found that when he had applied a given weight in the first instance to make any particular note, he had to double the weight to obtain

the octave, to add one-third extra only to obtain a fifth, a quarter for the fourth, an eighth for one tone, and about an eighteenth for a half-tone. More simply still, he stretched a cord, and then when the whole length sounded any note, when stopped in the middle it gave the octave, at the third it gave the fifth, at the quarter the fourth, at the eighth the tone, and at the eighteenth the semi-tone."

According to Plutarch, the interval from the earth to the fixed stars was considered the diapason, or extent of seven tones, and the distances of the seven planets, including the sun and moon, from each other, were expressed by tones and semi-tones in different proportions.

"The sphere of the stars was the common envelope or circumference of the universe, and Saturn, immediately below it, corresponded to the thirty-sixth tone and the earth to the first, and the other planets with the sun and moon at the various harmonic distances. One tone was reckoned from the earth to the moon, half a tone from the moon to Mercury, another half-tone to Venus, one tone and a half from Venus to the sun, one from the sun to Mars, a semi-tone from Mars to Jupiter, half a tone from Jupiter to Saturn, and a tone and a half from Saturn to the fixed stars, but these distances were not universally agreed upon." ("Astronomical Myths," p. 167. Flammarion.)

"There can be very little doubt, however, that by the harmony of the spheres, these philosophers only meant to illustrate the order supposed to prevail throughout the universe as known to them. Dr. Gregory infers from this idea a proof that they were acquainted with the Newtonian law of the decrease of gravity, and he believes that these philosophers have veiled their doctrines under an allegory when they assert that Apollo touched a seven-stringed lyre, which he supposed represents the sun and the seven planets. According to Macrobius, the sun retained the planets in their orbits by attractive forces in harmonic proportion. Because the tones obtained from cords equally thick but of different lengths are invariably proportional to the square of the lengths of the cords, he inferred that the harmonic proportion alluded

to in the attractive forces was the inverse duplicate of the distances of the planet from the sun. Nevertheless, few persons will, we imagine, be inclined to believe that the doctrine of Pythagoras, or of any of his disciples, lay as deep as is here supposed." ("Origin of Astronomy," by John Narrien, F. B. A. S., p. 166.)

Ocellus, Democritus, Aristotle and Lucretius, and all the best minds in Greece and Italy, both poets and philosophers, were imbued with the idea of the celestial harmony, and have left treatises on this subject, and almost all with the same title: "The Nature of the Universe." Plato, in his *Republic*, teaches that there is actual musical harmony between the planets. "Each of the spheres," he said, "carried with it a Siren, and each of these sounding a different note, formed by their union a perfect concert, and being themselves delighted with their own harmony, they sang divine songs, accompanying them with a sacred dance." He also believed that there were nine Muses, eight of whom presided over celestial, and the ninth over terrestial things, thus protecting them from disorder and irregularity. Cicero and Macrobius also expressed opinions with regard to this celestial concert. "Such great motions," wrote Cicero, "cannot take place in silence, and it is natural that the two extremes should have related sounds as in the octave. The fixed stars must execute the treble, and the moon the bass." Kepler improved on this, saying that Jupiter and Saturn sang bass, Mars takes the tenor, the Earth and Venus are contralto and Mercury is soprano. True, no one has ever heard these sounds, but Pythagoras could have answered such an objection as follows, when he said: "We are always surrounded by this melody, and our ears are accustomed to it from our birth, so that, having nothing different to compare it with, we cannot perceive it."

"There's not the smallest orb, that thou beholdest,
But in his motion like an angel sings,
Still quiring to the young-eyed cherubim:
Such harmony is in immortal souls;
But, whilst this muddy vesture of decay
Doth grossly close it in, we cannot hear it."

The doctrine of celestial harmony, by which was meant the music of the spheres, was common to all the nations of the East. To this divine music Euripedes alluded in the following words: "Thee I invoke, thou self-created Being, who gavest birth to nature, and whom light and darkness, and the whole train of globes encircle with eternal music." Schubert, in his *Symbolism of Dreams*, has the following passage relative to music: "It may be asked whether that language which now occupies so low a place in the estimation of man, be not the actual making of the higher regions, while we, awake, as we fancy ourselves, may be sunk in a sleep of many thousand years, or, at least, in the echo of their dreams, and only intelligibly catch a few dim words of that language of God, as sleepers do scattered expressions from the loud conversations of those around them."

The Rosicrucians' theories, with regard to the music of the spheres, are ably described in Hargrave Jenning's book, upon their rites and mysteries. They view the whole world as a musical instrument; that is, a chromatic, sensible instrument. "The common axis or pole of the world celestial is intersected—where this superior diapason, or heavenly chord, is divided—by the spiritual sun or centre of sentience. Every man has a little spark (sun) in himself. Time is only protracted consciousness. Earthly music is the faintest tradition of the angelic state; it remains in the mind of man, as the dream and regret for the 'Lost Paradise.' Music is yet master of man's emotions, and, therefore, of man. Heavenly music is produced from impact upon the paths of the planets, which stand as chords or strings, by the cross-travel of the sun from note to note, as from planet to planet, and earthly music is but a faint reproduction of the same, and 'a relic of heaven.'" The Rosicrucians taught that the "music of the spheres" is true, and not merely a poetic dream, "all nature, like a piece of music, being produced by melodious combinations of the cross movement of the holy light playing over the orbits of the planets; light flaming as the spiritual ecliptic, or the *gladius* of the Archangel Michael, to the extremities of the solar system."

They contended that music, or melody—which is enchantment—pervades all nature in its prosperous or intended progress, although it is only the wail or plaint of the soul, mourning for the "Lost Paradise." Music is the atmosphere of the spirits, the communication from the invisible spirits that people the air in greater or lesser number.

The Cabalists imagined that the arrangement of the stars in the sky, and the varying speed of the planets of the solar system, produced harmonious sounds. They taught that God "made the world" by the "means of music;" that music, as man knows music, is essentially a power; that (through it originally) everything was possible, as the gift of God; which explains the classic fables of Orpheus, Amphion, and the mythological wonder-workers in music. They believed that music is modulated in the movements of the planets, and that the human soul is so debased that it only catches intermittently the faint echo of the continuous universal music, which is the life and growth and splendor of everything. Music is magic, is sacred and a power—as all harmony must be. Music is always in the air, more particularly at night, for nature is necessarily more nervously sensitive at night, because more fascinating and mysterious. The Great Soul of the World, moving in the arc of the mighty pendulum between the two points, Life and Death, is continually urging its way toward "Rest." ("The Rosicrucians; their Rites and Mysteries." Hargrave Jennings, p. 245.)

Although we enjoy these quaint legends of the music of the spheres, which appeal to our imagination, yet the truths revealed by science appeal to us even more strongly. The master mind of Kepler evolved beauty and order out of the chaos of motion which had hitherto distinguished the stars of heaven. He discovered and rejoiced in the "harmonies of the planets," about which he wrote in his enthusiasm: "Nothing holds me; I will indulge my sacred fury; I will triumph over mankind, for I have stolen the golden vases of the Egyptians." Yet it would doubtless have seemed a strange thing to him, had he known that he had only heard

a few stray notes of the music of the spheres, that he had not yet—as he had hoped—

> "Come on that which is, and caught
> The deep pulsations of the world,
> Æonian music measuring out,
> The steps of Time."

Modern investigation has led us still further, and peering into the depths of space with the photographic eyes of science, we are enabled to roam from star to star, from sun to system, from system to universe, ever seeking that point from whence these millions of circling suns shall reveal the perpetual harmony which doubtless reigns throughout the universe of God, of which Goethe sung:

> "See all things with each other blending,
> Each to all its being lending,
> Each on all in turn depending,
> Heavenly ministers descending,
> And again to Heaven uptending,
> Floating, mingling, interweaving,
> Rising, sinking, and receiving—
> Each from each, while each is giving
> On to each, and each relieving
> Each—the pails of gold. The living
> Current through the air is heaving;
> Breathing blessings see them bending,
> Balanced worlds from change defending,
> While everywhere diffused is harmony unending."

# IMAGINATION.

By Arthur Lovell.

Nothing is so much abused and so much praised as imagination. Now it is extolled to the skies as a faculty endowing its possessor with God-like powers, now decried as a dangerous something which the practical man of the world must shun as his greatest enemy. Can any greater praise be given to the artist or the poet than to call him a man of imagination, and can greater blame be attached to the business man than to style him an imaginative creature? It seems as if the term "imagination" contained a variety of ingredients, about which nothing certain can be predicated, beyond a liberal share of abuse or praise. In fact, it is used in so many diverse significations, and the ordinary notions attached to it are so vague and shifting, that the first thing we must do is to define exactly what we mean by it. Contrary to what we should expect from the loose manner in which the word is generally used, an exact and simple definition is quite easy to give.

Imagination—derived from the Latin word, *imago*, a picture, figure, likeness, or material representation of anything—means *the power of the mind to form images.* The word "fancy," from the Greek *Φαγῶ*, I show, implies the same power, and is very frequently confused with imagination. Fancy bears the same relation to imagination that the seed bears to the plant. The characteristic of fancy is to revel in vagueness, to be content with half-formed figures or ideas, whilst imagination condenses them into clear-cut and perfect forms. *Image making is the primary and, in fact, the only meaning attached to imagination.* The illusions of the insane and the finest conceptions of poet or painter are the effect of precisely the same cause, the image-making power of the imagination. Great genius is to madness near allied, because in both these cases the images assume such distinctness of

outline as to be clearly visible, while with the ordinary person the force of imagination is necessarily weakened, and the images are not seen as a general rule. That they are, however, being constantly produced by every mind, sane or insane, and, in reality, form the staple of what is called "thinking," can be easily verified by observation and reflection.

In the introduction to his "Logic," Hegel explains why philosophy is such hard reading to the generality of mankind. "In one important point, philosophy has to contend with a difficulty unknown to the other sciences. We have *mental pictures of objects* before we think them; and it is only through these mental pictures, and by having constant recourse to them, that the thinking mind goes on to know and comprehend. It may be roughly said that philosophy puts adequate notions in place of *semi-pictorial and material conceptions.* This difference will explain why people find philosophy unintelligible. Their difficulty lies partly in an inability to grasp immaterial thoughts (in our ordinary state of mind thoughts are overgrown and combined with the sensuous or mental material of the moment), and partly in an impatient wish to have *in imaginative conception as a picture* that which is in the mind as a thought or notion. There is a hankering after an image. Our mind, when it is denied the use of its generalized images, feels the ground where it once stood firm taken away from beneath it."

It is important to bear in mind that this level of "material conceptions" or "generalized images" is in its several aspects the level on which stands the general mass of mankind. This is shown in the various branches of art, *e. g.*, sculpture and painting. The sculptor embodies in the marble, and the painter fixes on the canvas, the image in his mental sphere. Again, the difference between voluble "gift of the gab" and consummate eloquence consists, to a very large extent, in the image-making power of the imagination. Emerson, with that marvelous intuition of his which sees through the very soul of the universe, has explained the reason:

"The moment our discourse rises above the ground line of familiar facts, and is inflamed with passion or exalted by thought, it *clothes itself in images.* A man conversing in earnest, if he watch his intellectual processes, will find that a *material image, more or less luminous, arises in his mind, contemporaneous with every thought.* Hence good writing and brilliant discourse are perpetual allegories. This imagery is spontaneous. It is proper creation. It is the working of the original cause through the instruments he has already made. The poet, the orator, bred in the woods, whose senses have been nourished by their fair and appeasing changes, year after year, without design and without heed, shall not lose their lesson altogether in the roar of cities or the broil of politics. Long hereafter these *solid images* shall reappear in their morning lustre, as fit symbols and words of their thoughts. At the call of a noble sentiment again the woods wave, the pines murmur, the river rolls and shines, and the cattle low upon the mountains as he saw and heard them in his infancy. *And with these forms*, the spells of persuasion, the keys of power are put into his hands. We are such imaginative (literally image-making) creatures that nothing so works on the human mind, barbarous or civil, as a trope. Condense some daily experience into a glowing symbol and an audience is electrified. Put an argument into a concrete shape, *into an image*, which they can see and handle and carry home with them, and the cause is half won."

The point I wish particularly to urge in the foregoing quotations is that (1) Hegel refers to the image-making power of the imagination as the characteristic of ordinary, as distinguished from "philosophic" thought; that is to say, what is called "thinking" by the mass of mankind is pictorial representation or image-making; and that (2) Emerson assigns this image-making as the direct cause of the orator's success; the explanation being the love of mankind for distinct and vivid mental images.

We have now ascertained two simple, but very important facts:

*First.* The mind has the power of making images.

*Second.* These mental images are being formed *incessantly* by every being who thinks, sane or insane, illiterate or educated. Under certain conditions they become as visible to sight as what we call an "external object."

Suppose we ask: How are these images formed? And what "substance" are they made of (if popular language will allow the word "substance" to be used in connection with what looks so shadowy and *un*substantial)? It is obvious that in drawing a material figure we must use something that will serve to impose the limits we desire. Any original figure whatsoever, be it circle or triangle, must be drawn *somehow or other.* The draughtsman must use a pencil of some sort. Judging from analogy, we must come to the conclusion that "mental images" must be drawn *somehow or other;* that is to say, there must be something at work corresponding to the pencil in producing an effect. The problem "how" could be summarily dismissed a short time ago in the same way as the problem of creation was dismissed, by asserting that it was "made out of nothing." This belief, whatever credit or glory it reflected upon the Creator, was a most illogical and irrational conclusion, at bottom being mere shirking of the problem to be solved, and relegating it to the region of the unknown and unknowable, instead of grappling with the question in a bold and straightforward manner. *E nihilo nihil fit.* It was most absurb, therefore, to suppose that creation could be defined as making something from nothing.

It was a favorite thought of Paracelsus that the great world—the macrocosmus—was a product of the imagination of the Universal Mind, whilst the individual world of man—the microcosmus—was produced by the creative power of individual imagination. As the Universal Mind is not ruled by any external existence, so the firmament in man—his sphere of mind—is independent of any foreign power, and its creative force is practically unlimited. If man's imagination was strong enough, whatever he thought would take actual form in his soul. Imagination, he frequently repeated, is

the beginning of the *corpus* of a form, and guides the process of its growth.

On all sides men are now asking questions which half a century ago would have been considered preposterous and even blasphemous. In early stages of development it is natural to look upon "God" as a foreign being who has interests to protect and secrets to guard. The old gentleman who for the first time in his life saw a steam-engine speeding on its way at the rate of forty miles an hour, betrayed a spark of human nature, when he exclaimed: "Great God! if Thou dost not look sharp, man will get ahead of Thee!" But there is no fear of that. Rather the more we advance the more we see the infinite riches in store, and hear the voice, "Come, ye blessed children of my Father, inherit the Kingdom prepared for you before the beginning of the world." The characteristic of the present day is boldness of thought and indefatigable research. We have overstepped the bounds of timidity. Whatever opinion is held of the discoveries of Mr. Keely, no one can deny that he is the incarnation of the Spirit of the Time. "I do not believe in the line, 'God moves in a mysterious way His wonders to perform,'" he wrote. "In my estimation He moves in a very plain and simple way, if we will open our hearts to the understanding of His way. To the man who cannot appreciate the workings of nature, chemically and otherwise, God's ways may appear mysterious, but when he comes to know nature's work he will find simplicity in its highest order of expression. The study of the Deity by man being in the observation of His marvelous works. The discovery of a fundamental creative law of as wide and comprehensive a grasp as would make the etheric vapor a tangible link between God and man, would enable us to realize in a measure the existing working qualities of God Himself (speaking most reverentially) as we would those of a fellow man."

If man is the microcosm, the individual world, corresponding to and capable of explaining the macrocosm, the universal world—and this is the teaching of all the greatest and wisest of this planet—it must follow that the mental

processes occurring in the individual world are identical on a small scale with the processes occurring in the universal world on a large scale. Granting that, we must conclude that *imagination or image-making is the creative power of God and man.* In other words, the material universe must have existed first as a "mental image" in the thought-plane of Universal Mind. Creation, then, is not making "something out of nothing," but constructing forms on the mental plane and clothing them with matter. That this is the secret of "creation" in the sphere of individual mind, in the microcosmus, is a fact which requires no further proof than attention to our ordinary mode of thinking. All analogy justifies us in attributing the same process to the Universal Mind in the creation of the macrocosmus.

It is evident, therefore, that the question of how the mind is able to construct mental images, is not one of trifling importance, but a problem which, if satisfactorily solved, initiates man into one of "the existing working qualities of God Himself."

It is not necessary now to postulate the existence of "the hypothetical ether," as it used to be called by scientific men. The presence of a circumambient medium or substance pervading the whole universe and interpenetrating everything visible and invisible, without exception, is now universally acknowledged. We know it contains locked up in its embraces undreamt-of potentialities, which up till recently seemed only available for the daring romancer who dreamt magnificent dreams and beheld gorgeous visions of the power that could be wielded by the human race. Man is now actually grasping the ether for mechanical purposes, and trying to harness it for the daily work of the world.

Step by step, with unerring certainty, it can be demonstrated that the "airy nothing" from which mental images are constructed is the ether. Every link in the chain of evidence is complete, but as space would not permit a complete theoretical demonstration, I must content myself for the present, at all events, with the statement that the *imagination creates images or mental pictures out of the ether itself.*

Thought is etheric motion controlled and directed at will by the imagination, directly, without any intermediary. This has always been the postulate of old-time magic, and only on the supposition that imagination and will can control *at first hand* an instrument of supreme potency can its marvels be explained. Image-making is not a vague something, but the employment of a drawing pencil of exhaustless energy. Whatever properties of the ether may be discovered by the pioneers of the present day, will and imagination will command them. If the imagination of every thinking person, sane or insane, illiterate or educated, has the power of moulding the ether and compelling it to assume a certain form, how much more can the trained imagination and the disciplined will accomplish in calling forth the incalculable energies stored up in its embrace? Experience teaches that no matter how much learning a man may possess, his control over this mother-force is in proportion to the strength of his will and imagination. The two act in conjunction, and for their perfection demand the condition of faith or belief. Doubt weakens the power of both will and imagination, and as a necessary consequence loses control of the instrument to be employed. It is the same as if a carpenter lets go the axe with which he is working.

From this standpoint let us examine the teaching of Jesus of Nazareth. There is not a single verse in the whole of the New Testament which shows that the Founder of Christianity exercised a power that is not within the grasp of mankind in general. On the contrary, he who runs may read the great doctrine of man's inherent power. In view of the fact that man wields directly by his will and imagination the highest force in nature, is it not self-evident that Christianity—understanding by that much-abused word not the *caput mortuum* of Dogmatic Theology, but the living doctrine of Jesus the Christ—is the highest science?

The teaching of Christianity, then, is the elucidation of the laws of man, and is designed to train us to a use of the powers latent in ourselves. What we have been taught to look upon as "miracles" or "impossibilities," we must re-

gard as the manifestation of a force under our direct control. If we have been playing like little children with the greatest force in the universe, "etheric force," we must accept the teaching of the Master, and learn what He tells us. Here are some of His sayings:

"If ye had faith as a grain of mustard seed, ye might say to this tree, be thou plucked up by the root and be thou planted in the sea, and it should obey you."

"Whosoever shall say to this mountain, be thou removed and cast into the sea, and shall not doubt in his heart, but shall believe that those things which he saith shall come to pass, he shall have whatsoever he saith."

"If thou canst believe, all things are possible to him that believeth."

Jesus the Christ placed man at the head of creation, and proclaimed all the lower powers subject to him. Is not this the legitimate place of man, who has direct control of the ether? *It would be interesting to know what amount of force Mr. Keely would compute to be held latent in a "grain of mustard seed" of the ether.*

There is a tendency to regard the above sayings of Jesus as metaphorical, but it will be found that exact science will demonstrate them to be absolutely literal. The immediate followers and Apostles of Jesus partook, to a large extent of the Master's power. But he had often to rebuke their unbelief—a condition which robs man of his power over the instrument he is capable of wielding. Several of the Apostles performed wonders, or, as the Greek better expresses it, σημεῖα, "signs" of the unseen force. James expresses the indispensable condition of its action when he says: "The effectual, fervent prayer of a righteous man availeth much. But let him ask in faith, nothing wavering, for he that wavereth is like a wave of the sea driven with the wind and tossed. Let not that man think he shall receive anything of the Lord." The explanation is that the force of the will is weakened, and the mental image is blurred, consequently etheric energy is not set in motion.

Mrs. Crowe, authoress of "Night Side of Nature," about

forty years ago, wrote in a most philosophical manner on the subject:

"By means of the ether which pervades all space and penetrates all substances maintaining the connection between body and soul, we are in communication with all spirit as well as with all matter. And since the ether is the vehicle of will, a strong assertion of will may reinforce its influence to a degree far beyond our ordinary conceptions, but man is not acquainted with his own power, and has, consequently, no faith in his own will. He cannot, therefore, exert it; if he could, he might remove mountains. The power of will, like the seeing of the spirit, is latent in our nature, but meanwhile slight examples are found, shooting up here and there, to keep alive in man the consciousness that he is a spirit and give evidence of his divine origin. The power of will is a phenomenon that has been observed in all ages of the world, and as it was formerly much more frequently exerted for evil than for good, it was looked upon as black magic, whilst the philosophy of it being unknown, the devil was supposed to be the real agent, and the witch or wizard only his instrument. The evil magicians did not doubt their own power, and therefore they had the one great requisite, faith To will and to believe was the explanation given by the Marquis de Puységus of the cures he performed, and this unconsciously becomes the recipe of many other wonder-workers. He who cannot believe, cannot will, and the skepticism of the intellect disarms the magician. Hence, we see, wherefore in certain parts of the world, and in certain periods of history, these powers and practises have prevailed. They were believed in because they existed, and they existed because they were believed in. There was continual interaction of cause and effect, of faith and works. The more they were persecuted, the more they believed in witchcraft, and in themselves; when persecution ceased, and men in authority declared that there was no such thing as witchcraft or witches, they lost their faith, and with it that little sovereignty over nature that their faith had acquired."

It must always be borne in mind that the highest achieve-

ments of the imagination are only possible with firmness of will. The moulding of the ether into forms is generally done without a conscious effort of will, but for the triumphs of the art the will must be sustained.

Having now shown that man by means of his imagination and will has not merely an indirect, but an immediate and direct control of the *primum mobile* itself, the very storehouse of force, let us glance at the mental sphere or "firmament" of the microcosmus. It is obvious, *a priori*, from the very nature of the ether that time and space form no limit to mind as to the gross material body. Thought or spirit will, and imagination must, be able to manifest itself instantaneously at any point of space at any period of time. Therefore, man can have a mental sphere proportioned to his image-making power. His body is the centre of a circle of unlimited circumference. An image formed on the mental sphere *anywhere in space* must be able, if the will and the image be equally strong, to produce an influence corresponding to the force with which it was formed, on an individual, no matter what distance apart the body may be. This is the secret of thought transmission or telepathy. Individual spheres are constantly intermingling and blending with each other. This law explains how an Indian fakir can cause a crowd to see phantom lions, tigers, etc. Habitual practice has enabled him to bring the mental images to such a degree of perfection that he can impress them upon the sphere or "firmament" of others, who then see them as an external reality in space.

The image-making power of the mind plays a very important and very frequently the chief and only part in insanity. Under certain conditions, some of which are known, while others are not yet ascertained, the images which are being continuously produced gather such force that they become as visible as flesh and blood. Fear then intensifies this action, and the individual, in ancient language, is possessed with evil spirits, in modern language, is insane. On the principle that knowledge of a disease is half its cure, it can safely be predicted that the method of treating insanity with

success will undergo a complete revolution. *A superior will has the power of dissipating the illusions formed in the thought sphere of the insane*, and replacing them with images of beneficial influence. The "casting out devils" of the early days of Christianity is an illustration of the power of the will.

In conclusion, it may be pointed out that the image-making power of the mind can exert an influence of incalculable importance on the development of man. Ideals, or "gods," can be created, which by unerring law will react upon their creator, and eventually transform him into a more exalted being.

## SOME TRUTHS ABOUT KEELY.

By Mrs. Bloomfield Moore.

Long ago Mr. Keely said: "Science must hold the helm before the commercial value of my discoveries can be made known and comprehended." The speculative management prevailing has seized the reins of guidance so often that it has now become necessary to place the helm beyond its reach, in order that this richly freighted barque may not again be diverted from its proper course. Mr. Keely has been accused of refusing to teach his processes, but until within five years he had nothing to teach. It was Nature's secrets that he was doing battle with and daily risking his life to conquer.

Since 1892 he has held himself in readiness to instruct Professor Dewar (the resident physicist of the Royal Institution of Great Britain) in his process of dissociation; one of our best known American physicists having refused to receive this instruction, simply because of the "stock-booming" operations that have invariably followed upon all efforts of men of science (or of capital) to acquaint themselves with the merits of the claims made by others for Keely.

The article prepared in 1893, by the Rev. Dr. Plumb of Boston, in its description of what he called "a subsidiary engine," brought fresh discredit on Keely in the opinion of

educated and able men, and avalanches of ridicule from the ordinary journalists. The wheel described by Dr. Plumb was not an engine in any sense of the word. It was a machine that is a marvel of construction, entirely independent of centrifugal action, for diverting the polar current of apergy to do its work on its mechanical harness.

The *Philadelphia Inquirer* gave out, in printing this paper, that it had been written by an eminent scientist of Boston. The statements made therein were sufficient to establish in the minds of men of science the conviction that Keely, whom they held responsible for them all, was the "perpetual motion crank" he had been called, and too darkly ignorant of the simplest canons of orthodox physics to know the blunders he was making in his statements.

W. L. S., a Boston man of science, resenting this assertion of the *Inquirer*, undertook to reply in behalf of his maligned associates, succeeding so well that all men unacquainted with the system of vibratory physics considered Keely completely annihilated and thought he would never be heard from again. Said W. L. S.: "Take the description of the seventy-two pound wheel, with eight spokes and a hollow hub, but no rim, running at a speed so fast that the camera could not catch it and obtain a sharp image. If we estimate, from this and the description, the probable speed and then allow twenty-five per cent. for safety, and figure out the centrifugal tension in the spokes, assuming both spokes and hub made of the best wrought iron, we find it would come out something like one hundred and fifty times the breaking strength of the iron; so it seems to me it would be exceedingly dangerous to stay long within range of that wheel. . . . . I will end by calling Dr. Plumb's attention to the fact that there is in Boston, not half a mile from the post office, a perpetual motion machine now on exhibition; where the unwary are invited to enter, examine and subscribe. It is a waste of time to go to Philadelphia." —W. L. S., Jan. 17th, 1894.

It is no matter of surprise that, after such an apparent exposure of Keely's ignorance, New England journals which

had up to that time printed articles defending Keely, refused them afterwards. A brief mention of the helpers on this underground road, which Keely had so long been traveling without gaining a ray of light, should be of interest, now that the labyrinth is lighted with the effulgence of "The Dawn," in his discovery of the current of apergy.

About fifteen years ago H. O. Ward became interested in Keely's discoveries by hearing two Englishmen on board of a steamship discussing the nature of the mysterious force which they had been sent over by the English Government to investigate. Possessing certain eccentricities of character, such as persistency of purpose and a determination to reach the root of things before adopting the opinions of others regarding them, a visit was made in time to Keely's workshop, which eventually led to the forming of a conjecture that Keely might have dissociated hydrogen. Upon suggesting this possibility to him, he replied: "Perhaps so, I do not know," but the suggestion fell on pregnant soil and started Keely into making efforts to vibrate hydrogen, with such results that his field of experiment was greatly widened. The same possibility named to Lord Rayleigh brought this answer: "I will bet you ten thousand pounds he has not; hydrogen is an element." "I know it is classed with the elements," was the answer, "but science, starting with three only, now has over seventy. Why may not more compounds be found?" Lord Rayleigh a few years later refused to repeat his bet.

In 1884, Macvicar's "Sketch of a Philosophy" was brought to the notice of H. O. Ward (by Dr. Andrew of King's College, Belfast), who compiled from it "Ether, The True Protoplasm."

The late Robert Browning, before reading the monograph, remarked to its writer that the word "protoplasm" was not a suitable one to employ in connection with the ether. The writer replied: "I am hoping to convince the world of science that ether is matter."[1] Dr. Richard Garnett, the learned librarian of the British Museum, sent the manuscript to the

[1] In vibratory physics spirit is matter.

late Dr. Chapman, then editor of the *The Westminster*, who gave his opinion that it was fifty years too soon for its publication. The *Home Journal* of New York then became one of the helpers on the road and published it entire.

Those who constitute the vanguard of science are now ready to receive many of Dr. Maevicar's views, which were not appreciated in his lifetime. Keely at once understood them, and knew that he had imprisoned the ether; though making the error of thinking that it was the force itself, instead of the always necessary medium of its manifestation in our atmosphere.

This was four years before the distinguished Henri Hertz, late professor of physics in Bonn University, announced in the *Revue Scientifique* that all our electro-magnetic engines held the ether fast bound without this fact having been so much as suspected. Then, one of the best-known British physicists said; "If we have done this, why is it not possible that Keely has done the same?"

A copy of "Ether the True Protoplasm," published in 1884, in galley-proof slips, was sent, in 1885, to Professor Rueker, of the Kensington School of Science, who paid no attention to it, much to the disappointment of its writer at the time; but in 1889, in an address delivered at Cardiff before the Royal Association, he remarked that men of science were then investigating the structure of the ether, which might prove to be the source of all matter, and which might yet be used and controlled as we now use and control steam.

Prof. Dewar sent a copy of this paper to H. O. Ward, who replied with a request that the professor would inform the learned physicist that Keely had spent years of his life in vain attempts to use and control it in engines only to find that this can never be accomplished.

The next helper on the road was the late Mrs. F. J. Hughes, a grand-niece of Erastus Darwin, whose book on "The Evolution of Tones and Colours," Mr. Keely says saved him years of research in the realm of inaudible sounds.

Yet, with all this assistance, which seemed to come by chance, the goal of Keely's stupendous efforts would never

have been reached, so dark was the labyrinth in which he was wandering, had not one of the books of our late townsman, Dr. Seth Pancoast, been brought to his notice. It was on a page of this record of the wisdom of the ancients that Keely learned he had captured one of the currents of a triune polar stream of force; and from that hour he abandoned all efforts to imprison the ether in a metallic structure; devoting his days, and often his nights, to the gaining of a knowledge of the operations of apergy in nature. In 1893 he succeeded in demonstrating to his own satisfaction that he had fastened his machinery to the very wheelworks of the universe.[1]

Until this time he held this "secret of nature" locked within his own breast; for never once, in his nearly quarter of a century of research, has Mr. Keely broached a theory until he has proved it by demonstration.

The position taken at the last stockholders' meeting gives evidence that Keely's magnanimity of character has never been appreciated by those who have taken advantage of it in their business transactions with him. But he cannot be forced into further concessions nor into further delay. The ultimatum is reached. The risk of the loss of these discoveries to the world is too great to admit of giving one thought to mistaken and short-sighted counsels. Science must not be robbed of her birthright to satisfy the greed of Mammon.

There are from twenty to thirty instruments to be patented in Keely's system of sympathetic vibratory physics. Months of valuable time are lost, which might have been occupied in preparations for the taking out of patents, had Keely's generous proposition been accepted as promptly as it deserved to be. The spiro-vibrophonic system alone requires eight or ten patents; the resonating five or six more; the vitalizing six, which must be preceded by the setting up of a vibratory dynamo that would take weeks to construct and graduate. The sympathetic transmitting system will

[1] See a work by Prof. Kedzie, of Chicago, on "Solar Heat, Gravitation and Sun Spots," showing how this *everlasting* and *important* "etheric vibration" is manifested in nature.

require months, with its adjuncts, to get into a patentable condition; and the sympathetic governor of course must be patented if the other instruments are.

Mr. Keely will not again yield his judgment to the wishes of others, as he did in this instance to his co-worker; for both have seen the folly of it. From the first he has maintained his convictions that no physicist will be able to stand by him until his work is completed; owing to the manipulations in stock that have followed any consent from distinguished men of science to witness his processes, each time H. O. Ward has announced that they were going to do so within the last seven years. Keely's systems will now be brought out on royalties for the benefit of the shareholders and of the world, instead of for monopolies.

A New York journalist recently, in an article headed "Keely's Motor and its Future," tells his readers that "Keely finally settled" in Philadelphia. Born in this city, he has steadfastly abided here, using a stable as his workshop.

In conclusion, it may be stated that the force named in this paper Apergy, known to the ancients, and rediscovered by Keely, will hereafter be given the appropriate title of Keel, after the name of its latest discoverer.

## WHAT DAY OF THE MONTH IS IT?

By Lillie C. Flint.

Time has been characterized as that wherein there is room for events to happen, as in space there is room for things to be found. Sir Isaac Newton says, "All things are placed in time in order of succession, and in space in order of situation." The limit which occurs *when* and *where* one portion of duration ends and another begins is called an instant. It differs from a minute, which, although small, is a definite portion of time. "Wait a minute," says the busy person. The instant makes the realized *now*, but does not continue. This was considered so by the ancients, as some of them have no present tense in their language.

*Now* has some limit and can be held before the mind; as "Now we see," and "Now we are going." Relative, apparent, and common time is some measure of duration by means of motion which is commonly used as hour, day, month, year. A convenient measure of time and a natural one is found in the rotation of the earth on its axle. This has three qualities requisite for good measure; 1, Suitable size; 2, Easy application; 3, Invariable.

The ancient astronomers have left us very ample information about their dials, water and sand clocks, and similar timepieces, but are very reticent as to how they were controlled. Ptolemy states nothing of how time was found when the numerous astronomical phenomena which he records took place, but Hipparchus gives a list of twenty-four stars scattered over the sky, at intervals of right ascension, equal to exactly one hour, so that one or more would be exactly on the meridian at the commencement of every sidereal hour. Although this accuracy of time could be obtained by the ancients, it was not considered necessary, as they record their phenomena as taking place "about the middle of the third hour." The Arabians had a clearer idea of the importance of time, as in recording an eclipse they seldom failed to measure the altitude of some bright star at the begianing.

For nearly two hundred years, until the use of the pendulum became general, the astronomers could place no reliance on clocks, but determined the time by observations. From being at first untrustworthy, observations are made with such accuracy that they have been brought to the greatest perfection, and equally trusty timekeepers are placed in the hands of travelers.

The most comprehensive division of time, the year, is that well-known duration in the temperate zones during which the four seasons have run their course, and is indicated on all parts of the earth's surface by the apparent return of the sun to the same place in the heavens.

The early method of determining the length of the year, was to make it include a certain number of lunar months, the lunar month being, after the day, the first division of

time that was fixed. Although this was a close approximation, it was soon found necessary to add eleven days.

This was done in different ways by different nations. The Egyptians, who knew the year of three hundred and sixty-five days before Christ, had three seasons, "summer," "winter," and "the Nile." Of their months, each had thirty days, and five intercalery days were added at the end of twelve months. The Greeks retained their year of three hundred and fifty-four days, but added three months in every eighth year, and gave an additional month to the third, fifth and eighth year of every cycle.

The Romans abolished in all countries, under their sway, the old manner of reckoning the year by lunar months, and compelled the adoption of the Julien year which contained three hundred and sixty-five days and six hours; but in the sixteenth century this was changed to the solar year of three hundred and sixty-five days, five hours and forty-nine seconds, which differs only a few seconds from the true year, and this was compensated by a succession of leap years.

The Thebans are said to have first discovered that the addition of six hours was necessary, and this was corrected to still greater accuracy by Copernicus and Tycho Brache to forty-eight minutes and forty-five and one-half seconds. All these calculations being made without the aid of a telescope, their nearness to the truth is remarkable.

The time that the year begins varies with different nations. The Carthaginians and Egyptians and some other Eastern people commenced their year at the autumnal equinox. The Greeks commenced theirs at the winter solstice, but this was changed to the summer solstice. The Mohammedan, being a lunar year, has no definite time, but goes backward among the months.

Month is a period of time defined by one revolution of the moon around the earth, and is shorter than the division now called the calendar month, which is the general legal meaning of the word in the United States.

The names of the months were given by the Romans, and though Charlemagne in the ninth and the French Directors

in the end of the last century, attempted to substitute descriptive epithets, the old established names continued to be preferred.

Month's Mind is the name of the Roman Catholic office, continued through thirty days or repeated at the end of that period, mind being used in the sense of remembrance.

Week was a period of time adopted by the ancient Egyptians and Hebrews. Its origin is referred to in one part of the Mosaic account of the creation, and to the exodus from Egypt. Ancient writers, of which Josephus is one, speak of it as not of Hebrew origin, but as in common use among the Oriental nations. The week was probably suggested as a division corresponding to the four quarters of the moon, and although it was a civil institution among some of the earlier nations, the Jews were the first to give it a religious signification.

It seems certain that the Assyrians derived their week from the Babylonians, who also observed the seventh day as a day of rest. The Greeks had a week of ten, and the Romans of eight days, but after the introduction of Christianity the practical Romans saw the convenience of the week of seven days, and adopted it.

The days of the week were supposed to be named after the seven planets then known to the Egyptians, each day being named from the planet to which the first hour of the day was dedicated. The Jews had no names for the days of the week, but simply counted them. There was no special day for the beginning of the week. The Egyptians began on Friday and the Jews on Saturday.

The Chinese and Thibetans have weeks of five days, named after the five elements, iron, wood, water, feathers and the earth.

Day is the period of the earth's rotation on its axis. In common life the day is measured by the return of the sun to the meridian. The day, according to which clocks and watches are regulated, is the average of all the days in the year. The word day is also used in opposition to night, to denote the time that the sun is above the horizon.

Astronomers reckon the day as beginning at noon, and count from one to twenty-four hours. A civil day begins at midnight, and the hours are counted in two divisions of twelve hours each. A day in law means twenty-four hours, and a lawful day is one in which any legal act may be performed, and includes all days except Sundays and legal holidays. In the time of the Jews the Sabbath was the only day that had a name. The others were simply numbered.

*Lucky days* are certain recurring days that persons fancy are fortunate to themselves. Cromwell's day was the 13th of September, on which day he was born, won the battle of Worcester, and died. Napoleon's day was the 2d of the month, on which day he was made Consul, crowned, won the battle of Austerlitz, and married Maria Theresa.

*Unlucky days* vary with different people. The most noted among the nations speaking English is Friday, to which day, by common consent, until recently, have been assigned all capital executions of the law on criminals. It is not so many years since it was almost impossible to induce sailors to start on a long voyage on that day.

*Red-letter days* are called from the practice of printers of almanacs denoting holidays, fasts and festivals by red ink, all others being in black.

The motion of the sun among the constellations gave the year, the same relative motion of the moon gave the month, and the rising and setting of the sun, giving alternate light and darkness, gave the day.

An hour is the measure of time equal to one-twenty-fourth part of a day. When the day was first divided is not known. Herodotus says that the Greeks first obtained and practiced this from the Babylonians, but the Babylonians and Egyptians extended their division of time only to that part when the sun was above the horizon. Consequently, the length of the hour was constantly changing. The division of the day, as well as the night, into twelve parts was not practiced by the Romans until after the Punic Wars. The Chinese divide the day into twelve hours, one of their hours being equal to two of ours. They also reckon from an hour

before midnight. In Italy the hours are reckoned from one to twenty-four, and the Japanese still follow the old method of reckoning from sunrise to sunset.

Minutes and seconds, the smallest divisions of an hour, are from the Latin, signifying small or diminished, and were first used by the Romans. A minute was first called prime minute, and a second, second minute.

Writing was practiced many centuries before writers began to assign dates to the events which they narrated. There can be no accurate date without a fixed point for starting, and at first each community had its own method of reckoning. The most important of these systems were those of the Greeks, Romans and Babylonians.

The Jews fixed the era of Nabonassar, 747 B. C.; the Greeks fixed theirs by the Olympiads, 766 B. C., and the Romans by the founding of the city, 753 B. C.; but it is noteworthy that these great epochs all lie near the middle of the eighth century B. C. Dionysius introduced the method of dating from the birth of Christ.

The Chinese and other nations of Asia reckon years, months and days by cycles of sixty.

It is easy enough to reckon back to the division of time into hours, minutes and seconds, but it is not so easy to tell when clocks were introduced. In early times anything measuring time was named a horologium, from the Greek word, hour-teller, and it was not until the fourteenth century that the word clock was used instead.

The most primitive clock, and the one first used by savages, was a stick set up in the ground, which gave a rough estimate of time by the variation of the length of the shadow, but as this could only be of service when the sun was shining, something else became necessary. The dial is an instrument used to tell time by means of rays of light, and there are three kinds, the solar, lunar and astral dials, but the sun dial was the one commonly used.

There is a reference to the dial in the Scriptures,—the dial of Ahaz,—but the one of which we have a precise account is that of the Chaldean astronomer, Berosus, early in the third

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century before Christ. There is no evidence of sun dials among the Egyptians, nor representation among the sculptures, but, perhaps, the obelisks were erected in honor of the sun, and even used to determine the hours of the day.

The Tower of the Winds of Athens, which is somewhat later than the time of Pericles, has eight sundials, four facing the cardinal points and four the intermediate points. The Romans were neither astronomers nor geometers, and their first dial was taken from the Samnites. In the eighth century watches and clocks began to supercede the sundial, which then fell into disuse. Some of them were made small and easily carried in the pocket and were known as portable sundials.

The hour-glass was a very good instrument to measure the lapse of an hour, but could not give the time of day. It was, however, employed in churches until the sixteenth century. King Alfred's device of twelve candles, graduated so as to burn two hours, was not much better.

The Clepsydra was an advance on these; it was a water jar containing several gallons of water, with an orifice at the bottom of the jar in such a manner that the water would be lowered to a certain mark every hour. The jars were filled with water every morning at sunrise and marked off the hours with tolerable regularity, but, as glass was not used for the jars, it was necessary to look into them or measure the depth of the water. It is not known by whom these were invented, but they are attributed to the Greeks. Shortly after this they were improved by the addition of a wheel at the bottom to regulate the flow of water, and in this way they were used in the East for two thousand years.

As further improvement was called for in the West, the Saracens substituted weights for water to turn the toothed wheel, but it is known that about the year 1000 Gerhardt did construct a clock with wheels and weights. The first clock for striking the hour was used in Westminster Cathedral in 1368.

The invention of the pendulum is commonly attributed to Galileo, in the well-known story of the vibration of the chan-

delier in the church at Florence. The tall, old-fashioned clock, formerly in use, was superceded in 1814 by the invention of "short shell" clocks, smaller and more convenient.

The construction of the watch is essentially that of the clock, with the exception that the motive power is the spring. The clock was the mother of the watch, and the first one was made by Peter Halle, a clockmaker of Nuremburg. It required to be wound twice a day and was worth $1,500.

The watches first made in England, though very accurate, were thick and clumsy, as the name "bull's-eye" or "turnip" would indicate, and nearly all were made by hand. An American was the first to conceive the idea of making watches by machinery. The Swiss had arrived at great perfection in this art, but the authorities prohibited, under severe penalties, the exportation of drawings and models or machinery, and prevented as far as possible the emigration of workmen. But after a year's hard labor, the first watch was completed in this country in 1853, and since that time there has been no limit to the development of this industry.

The civil calendar of all European countries has been borrowed from the Romans. Calendar is from the latin word, calendrium, which signifies money-lender's account book, because interest was payable on the calends. The calendar of Julius Cæsar was in use in all Europe until 1582 and is still used in Russia.

The attention given to astronomy by the Eastern nations, and the practice of divination by means of the stars, led to the early construction of such tables as comprise our almanacs. These tables were first used by the Arabs, mainly as astronomical guides, and from them became known among the Alexandrian Greeks and in Europe. Manuscripts of some of these of the middle ages are still preserved in some of the English and continental libraries.

Our information is extremely slight concerning them, but we are well informed regarding the *fasti sacri* of the Romans. Originally, the knowledge was confined to the priests, whom the people had to consult about the dates of festivals as well

as of the proper time for instituting legal proceedings. At about 300, B. C., one Cunius Flavius, the secretary of Appius Claudius, possessed himself of the secret, either by stealthy use of the documents of his master, or by repeatedly consulting the priests and jurists and recording the particulars of the information he received. And it was neither more nor less than the publication of an almanac when, as Livy relates, he exhibited the fasti on white tablets around the Forum. From this time tablets containing the calendar, festivals, astronomical phases and sometimes historical notes seem to have been common.

The researches of antiquaries have brought to light numerous fasti or calendria cut on marble and other kinds of stone. They were sometimes carved on the handles of swords and the handles of hatchets. The Farnese rustic calendar is a cubical block of stone, on each of whose four vertical faces three columns are engraved, detailing for each different month the number of days, the dates of the nones, the length of the day and night, the sun's place in the Zodiac, the tutelary deity of the month, the rural operations of the seasons and the chief festivals.

An almanac for 1836, prepared in the year 300 by Petrus of Darcia, containing chaotic astronomical, chronological and medical data, was recently published. The first printed almanac is believed to be that of a German astronomer, published in Vienna, in 1457. Almanacs of a rude kind, known as "Clogg Almanacs," were used in England; these were square blocks of hard wood, about four inches in length, with notches along the four angles corresponding to the day of the year; the weeks were indicated by a deeper notch for every seventh day, and a broader stroke on the upper side indicated the first day of every month. Other characters on the upper side were for saint's days and festivals. Thus, Epiphany was indicated by a star, and Saint Valentine's day by a true lover's knot.

The first almanac printed in England was a translation from the French. The exclusive right to sell "almanacs and prognostications" was given in Elizabeth's reign to the com-

pany of stationers and was extended by James I to the two universities. Amid various productions, of which poor Robin' Almanac was the most noted, they flourished until the privilege was repealed in 1775. It is said that it is difficult to find in so small a compass an equal quantity of "ignorance, profligacy and imposture."

The influence of the heavenly bodies on the affairs of men has been believed in from the remotest times, and this seeming to fall within the almanac maker's province, was carried to such an extent that in 1579 Henri III, of France was obliged to prohibit political predictions. The most noted almanac in this country is Franklin's celebrated "Poor Richard's Almanac," which became very popular both here and in France and England on account of its wise utterances.

Not the least noticeable are the almanacs of the patent medicine dealers, both in the United States, France, England, Germany and other countries, which are given away by the millions.

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## THE BUILDING OF A MIND.

By S. Millington Miller, M.D.

Often, while traveling by railroad, or riding, or driving through the country, I have noticed the picturesque tramp extended at full length, in sweet slumber, upon a green bank in the shade beside some stream, or crouching close to a small fire of sticks and gnawing a bone. And the thought has repeatedly passed through my mind as to whether it was a providential blessing, or the reverse, that this same squalid, illiterate chap had not the slightest possible notion what he could make out of himself, and how great and powerful he might be if he simply started out at any given time and exerted continuously every power of mind and body until he had reached the highest possible goal of his endeavor.

Henry Drummond, in that most fascinating of all his books, "Tropical Africa," was led into very much the same vein of speculation at the sight of the scanty possessions and

still scantier garb of one of the ebony children of the Dark Continent. He made up his mind on the spot that no one could ever know how much a man might possess and how great he might become, until one had actually seen with his own eyes how little a man could have and how utterly insignificant and knowledgeless he might be and still be a man.

Napoleon beside an idiot—not even such an infinity of extremes can typify the untold potentialities of conscious mechanical improvement in the mind and body of man.

The only proof, of course, of the possibility of constructing a Napoleon out of an idiot, would be the actual performance of the feat. In lieu of its accomplishment, my present purpose is simply to set down a number of facts in general, which, taken together, go far to show that such an accomplishment is only a question of time, provided other conditions are favorable.

The public is well acquainted with the fact that the food which he eats, and the stock from which he springs, and the environment by which he is surrounded, are of tremendous importance, as formative agents, in moulding the mind and body of the child. And in the brief space at my disposal, I can only refer to these facts without sparing the time for extended details.

What I think, is indicated by the facts which I will proceed to relate, is that man has an extraordinary power over brain and body tissues; those of his own brain and body, or those of the child whom he may be conscientiously endeavoring to develop to the utmost possibilities of its nature. The assumption of these possibilities is, of course, utterly opposed to that belief, which one hears so commonly expressed, and which is best described by the name of "Kismet."

According to this theory, our lives are all predestined. It matters not whether we start out and work or whether we go to bed and sleep. In either case, we will become just what it was intended we should be—the millionaire's son a pauper —the beggar's child a millionaire—the outcast the greatest statesman of the age—the son of the wise man a "ne'er do 'ell."

The deaf child can be taught to hear by watching the lips of those who are speaking, and the dumb child can learn to speak with the voice, *articulately.*

It is a very common popular error to speak of the deaf as "deaf and dumb." The only affliction, in the vast majority of such cases, is that of deafness. The child is dumb because it has never heard any sound. Children learn to use their voices entirely as an imitative process in their very tenderest years. They hear a constant hum of words around them, and with vocal chords all ready to be used they imitate, first the simpler and then the more intricate complications of vowel and consonant sounds.

But the deaf child is barred from all this world of sound, and grows up without using its vocal chords. And just as my muscles become flabby and strengthless if I never use them, so the vocal chords of the deaf child (which are mainly muscular fibre), first grow flabby and then hang down like an over-stretched rope.

What is done at an Oral School for the education of the deaf is to gradually but efficiently tone up these undeveloped vocal chords. It stands to reason, of course, that the younger the pupil is the easier and shorter will be the process of his training—I mean the training of these disused organs of speech. If the deaf person comes to this special school late in life, it will be a much more serious and sometimes impossible matter to restore that lost function, voice. Their disuse has become a habit with his vocal chords.

But when it is a very young child that is received in such an institution, the very gifted lady who has charge of the primary class, develops the voice in this way:

First, she gains the child's affection, and makes it love her. Then she has the child place one hand on her lips and another on her throat, and she makes the "A" sound—over and over again. And the child patiently imitates her until it has succeeded in nearly, if not altogether, acquiring the same power. She then gives the child some little present as a reward for work done so well, and lets it run off and play. In subsequent lessons the other vowel sounds are taught, and

then the consonant sounds, and then simple words. The result of this is that at the end of eight months this child who heard nothing and had no articular voice, not only speaks in simple words itself, but has all the while been learning to hear her speak by watching the movements of her lips. It has not only secured an ear in the shape of its eye, but at the same time those toneless and sagging vocal chords have been imperceptibly developed, day by day, until they are once more the ever-ready ministers of speech, armed *cap-a-pie.*

At Elwyn, near Media, Pennsylvania, some fifteen miles south of Philadelphia, there is an institution known as the Pennsylvania Institute for Feeble Minded Children, which is educating nearly one thousand mentally-deficient folk within its walls, besides affording a home to almost as many more "castaways of the mind."

Through its gates is constantly tramping inwards an army of staring, soulless eyes, of flat or conical heads, of watery, open mouths—clumsy, listless, stupid soldiers. After a longer or shorter series of years, this same array marches forth again into the world, little inferior and, perchance, equal to its average citizens.

The idiotic child at its admission is often much lower than the dog in the scale of being. Lower because it utterly lacks the moral sense possessed by that affectionate animal. With this perversion, or absence, of moral sense is a greater or less deficiency of all the senses. And this child that has no control over the involuntary muscles; that notices no light unless it be one of great intensity and brilliancy; that can stare the sun full in the face without winking; that prefers salt to sugar, the smell of asafœtida to the odor of the rose; that enjoys having its teeth pulled out, and is rapturous with the delight of being pricked with pins; that runs its finger roughly along the sharp blade of a razor and marvels, with curious eyes, at the sudden red flow from its severed flesh: this child is put through the same physico-mental exercise as that by which Sandow's muscles are developed. (Sandow stimulates cell growth in his biceps by the constant use of dumb-

bells of gradually increasing weight.) Harder and harder blows of each particular sense are sent through the special afferent nerves until the gray-matter cells of the child's brain, whose function it is to reconvert the energy of sense into the energy of thought, and that again into the energy of motion, are stimulated first into action and then into growth.

The vocal chords of the congenitally deaf child sag like the over-taxed strings of a steel cross-bow. But as the child is patiently and perserveringly taught to make the "a, e, i, o and u" sounds, and then the consonant sounds, and then word sounds, the sagged chords tighten up and grow tense and taut.

The brain of the normal man is like the thousand volt dynamo with endless layers and windings of delicate wire. The brain of the idiot resembles the ten-volt dynamo—coarse coils of wire and fewer of them. The difference between the wise and the foolish is, therefore, only one of comparative complexity of brain structure.

Repeated blows of light sent through the afferent nerves of sight to the centre of sight in the brain stimulates more and more its undeveloped toneless idiot cells; causes the blood to surge to them and through them, and finally rethrone the disthroned sense and thought of sight. Blows of sugar taste (not salt taste) sent repeatedly through the afferent nerves of taste, produce the same regenerative changes in the taste-centre cells. The same process is pursued with the senses of hearing, of touch and of smell.

When all of these sense-centres have been not only stimulated but developod, two other wanderers—mentality and moral sense—come home again and occupy the long vacant house.

This process of mental development requires in many cases an endless series of years for its perfection. In some instances little short of a small eternity would be necessary. The lower the type of idiot, the longer the period of years and the greater the amount of devoted long suffering and patience required on the part of the teacher. Progress is

slow at first and rapid toward the end. The only impossible factor in the treatment of the most aggravated cases of idiocy is the comparatively limited tenure of the average human life.

The bodies of many of the Elwyn children upon admission are of sadly low animal type as appearance goes, and, strange as it may seem, these vile bodies improve *pari passu* with the mental development, (the cell stimulation and regeneration). The hanging chin rises, closing the lips; the soulless eyes sparkle with regained intellection; the drooping, listless walk disappears; the brutish face softens and is humanized; the flat or conical head shows a gradual and steady metamorphosis of shape.

A gentleman connected with one of the largest institutions for the education of the deaf in this country, has recently corroborated, over his own signature, the report of an interview in which the statement was made, *that he could cure dumbness by hypnotism.*

As the hypnotic influence is known to be carried to the motor-centres in the brain through the "end organs" of hearing, and as this apparatus in most of his pupils is congenitally defective, I do not understand what medium he employs to establish the power of his own will in the gray-tissue-motor-centres.

This slight (?) difficulty, obviated, however, there is no earthly reason why his will, working through these motor-centres on the toneless vocal chords of the congenitally deaf child, should not first stimulate them into action and then into genuine and constant growth. The orally educated child learns this vocal development by methods which I have already described, but which necessitates the employment of its own volition. If some means has been found by which a stronger volition than its own may beat upon its brain-centres, the education of such a child is by this very power of interference immeasurably simplified.

The thin, tightly-drawn lips of the ascete are brought into this condition of tenseness and constant contraction by his own will power. Duty and high thoughts banish all ideas

of sensuality and pleasure from his mind, and his lips are but a reflex of the sternness of his purpose and the straightness and narrowness of his path.

The truth of the Biblical query as to who can add a cubit to his stature by the thought of it, is open to serious question. There seems to be no good reason why a man by constantly stretching his body, and by having his thought all the time fixed on that purpose, may not in reality cause the very condition of affairs that he desires to come to pass.

There is unquestionable authenticity in medical literature for the fact that heart disease is frequently and actually produced by a state of mind which not only dreads but anticipates such an occurrence. And the saying is well-known that ninety-nine people out of a hundred who die of the plague never have it.

There is truth in phrenology and physiognomy. This truth may be two-fold,—not only may certain conditions of head and face indicate the possession of certain mental qualities, but it is certain that the will itself, by repeated blows of itself on certain parts of the body, can and does by the very act cause blood to tend to those parts, and so produce an entirely unexpected and phenomenal development there.

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## THE TYRANNY OF "SCIENCE."

By Catherine Walter.

In these days of revolt against tyranny of all kinds, it seems to me it would be well to raise a protest against the tyranny of what is dignified by the name of "Science." Not the real thing implied by the word, nor would I condemn its humble votaries; for the truly scientific mind is always humble. It knows that there is no such word as finality, but that all science is progressive, and that the wisest of us are only re-discovering old truths, and adapting them, often imperfectly enough, to our modern needs. But the less science

a person has, the more apt he is to be arrogant, and to seek to impose his dictum on us as final and irrevocable. And so with each little branch of the vast system. It knows all there is to know in heaven and earth, and under the earth, or so it thinks, and declines to believe that there can be any knowledge outside of its own circumscribed limits. To the great mass of people who are incapable of thinking for themselves, from lack of education as much as from lack of intelligence, the words "Science," "Scientific men," are a kind of fetish, and when used to back up an argument, or to cast ridicule on one whose experiences and observations do not tally with hitherto accepted formulæ, are sufficient to block all enquiry into the truth or reasonableness of the opponent's evidence. They do not know enough to find out if true Science knows anything of its reputed offspring, or if the men are really "Scientific" in the broadest sense of the word, and therefore competent critics of a matter that has not come within their ken.

Of all the "Sciences" so-called, the one that affects us most directly, and perhaps the most inexact of all, is "Medical Science," because it starts out with the premise that living human organisms are dead matter and all its conclusions are based on that hypothesis. Consequently all its deductions are false, and that is why we see sickness and physical disintegration, which we call death, all around us, because we do not seek to understand this subtle force that maintains our physical organization in its integrity. The mere physical organization without the life principle is dead matter, speaking broadly, for of course there is no such thing as dead matter, though there are degrees of vitality. But we call it dead because it has ceased to correspond to our intelligence. But does medical science know anything of this life principle or of the harmonious conditions essential to a sound physical and mental organization? Not the first thing. Psychology is still considered by the old school as a long word of doubtful meaning, and the average medical man is satisfied to go on killing us according to "regular" methods. The question is, should we be satisfied to allow ourselves to be killed ac-

cording to "regular" methods, when we might preserve our lives by the exercise of common sense and any method that commends itself to our intelligence as responsible members of the community? If all the "Science" in the world were boiled down to make one good, strong solution, there would not be enough of it to make one little fly and endow him with the breath of life. And yet, in the name of "Medical Science," and in virtue of a piece of parchment, a medical man with his noxious drugs, the properties of which he does not understand, will wantonly destroy the harmony between the wonderful piece of mechanism we call the body and the life principle that informs it, with the less compunction inasmuch as he believes that "the dead tell no tales." And so he shakes off his responsibility for the life that he has recklessly hurried into another phase of existence through ignorance of what constitutes life.

And yet these same old-fashioned "regulars" who do not hesitate to prescribe a virulent poison, if warranted, as they ignorantly imagine, would draw the line at hypnotism, nature's own medicine, if properly understood and rightly administered. Is this a scientific standpoint? Is it not rather ignorance, jealousy and bigotry that prompts the opposition to what we now call "hypnotism," and its allied methods? Of course charlatans and tricksters abound in every profession, but we do not, on that account, condemn the profession. At the late Medico-Legal congress held in New York, one of the prominent papers read went to prove that suicide is justifiable, and another that there is a still more dreadful and wholesale method of poisoning our fellow-creatures than any of those already introduced to our notice by "Medical Science." Dr. Forbes Winslow's paper on hypnotism, and the stand he takes on the subject of alleviating the sufferings of his fellow-creatures, is in line with the most advanced and intelligent modern thought in Europe, which is far ahead of us in practical application of psychology. If the former generation are too old to learn, let the younger generation be taught that life is sacred, and that any science that does not take the subject in its fullest scope, is

not worthy the name. And we shall soon no longer hear that young medicos expect to kill so many per cent. of their patients, and know that their expectations are more than realized.

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## AN OLD MIRACLE—NEW SCIENCE.

By Mary Parmele.

Of all the miraculous narratives chronicled in the Bible, probably none has been made such a target for ridicule as the falling of the walls of Jericho at the blast from the trumpets of rams' horns. This has seemed too childish for serious consideration, the very climax of the absurd. It would be singular if science should find in this event a beautiful illustration of the action of a law of nature.

Modern science has reduced our material universe to a vast congeries of whirling and oscillating atoms. Whether matter is solid, liquid or gaseous is merely a question of the closeness of proximity of its particles. If these particles are in tight embrace (as it is their tendency to be), the result is what we call a *solid*. If this cohesive force is resisted by the atoms, they become more widely separated, so that the force acts more feebly, the atoms, instead of embracing, glide around each other, and there is formed what we call a *liquid*. If they become still farther separated they reach a point when the fetters of this cohesive attraction are completely broken; the captives are free, and turn out to have very decided wills of their own, and no fancy for each other at all. They rush swiftly apart in direct lines through space, colliding recklessly with every thing in their path. In this final condition we know matter as *gaseous*.

Now the agent bringing about these several changes in condition we call *heat*. But when we so call it, we give it the name which properly belongs to the sensation which it produces upon our nervous system. What gives us the sensation of *heat* is, in fact, an accelerated motion in the ultimate particles of matter. These are always in motion, they

never cease to vibrate even in the heart of the granite, but when the rate we call *heat* is attained, they not alone vibrate with a greater velocity but with a wider swing, requiring more space in which to act. So the result is an expansion or dilatation in the mass of which they are constituents. This is what has happened, when, as we commonly say, the water, or the piece of wood, or metal, has "expanded with heat." It is simply that its particles have been excited into violent action requiring more space, and have crowded each other apart with such force that no humanly forged fetters could have compelled them to remain in closer union.

There is inconceivable energy in this atomic motion. Its *will* and its *will not* are irresistible. Mountains of granite cannot hold it, and the foundations of the earth give way before it. Professor Tyndall says that the energy expended in condensing aqueous vapor into nine pounds of water, is equivalent to the "*descent of a ton weight, urged by gravity, down a precipice twenty-two thousand eight hundred and twenty feet high.*" He says: "I have seen wild stone avalanches of the Alps which smoke and thunder down declivities with a vehemence sufficient to stun the beholder; yet to produce enough snow-flakes for a child to carry has required an energy competent to lift up these shattered blocks and pitch them to twice the height from which they fell."

Such are the imperceptible forces at work all about us, and such the enormous expenditure of energy employed in making the snow-flake, the dew-drop, the hoar-frost, the mist and the rain. Who shall say the *invisible* is not awe-inspiring?

Man has learned to tap some of these streams of force for his own purposes. It is the energy of the rushing *atoms in the furnace* which moves the rod and piston in the engine; the steam, being only the vehicle for transferring and translating a natural force into a mechanical one.

But we have to do now not with *heat*, but with her less ardent and impetuous sister, *sound*. At a lower rate of atomic speed there is generated in precisely the same way what is described as *sound*. When the atomic vibrations

are quickened to a certain rate of velocity they begin to reach our perception through the ear, and the same energy which disintegrates as *heat*, in these, its earlier stages, delights us with "concord of sweet sounds." Subject to the same laws, acting in the same way, the difference between these unlike sisters seems a matter of *degree*, not *kind*. The quicker the vibration the higher the pitch of the note sounded; until, beyond a certain limit, the ear ceases to respond, and (for us) they are lost in silence, the human ear being set in an infinitesimally small span of this scale of infinity.

Now this accelerated action of the motion, resulting in sound, forces the atoms apart, and compels them to occupy greater space, just as does the more violent action which we call heat. They must and will have more room in which to move. Not a difficult thing to accomplish in the aerial medium which is the usual vehicle for sound, where, as we have seen, the atoms occupy larger space. But when the motion is communicated to solids, the force is sometimes disruptive, just as it is in the heat stage; and it has long been an established fact that under *certain conditions* sound will break solid substance.

There is still another quality ascribed to these atomic vibrations. They are not mechanically and in soulless fashion beating and throbbing their hearts away in space, but there is music and poetry in their atomic souls. They are *rhythmic*. Shakespeare and Beethoven are not held more firmly by the laws of *rhythm* than are these atoms, which have also the divine attribute of—*sympathy*. Things attuned to a certain rhythm will respond (audibly or inaudibly) to that rhythm, when it is sounded near them.

Try the experiment by sounding over a piano a resonant G. Every G string will tremble and sing, as will also (but more faintly) those strings harmonically related to the same note. The constituent atoms have been sympathetically stirred into activity at hearing the note to which they are attuned, and they sing responsively. This is "*sympathetic vibration*."

Professor Tyndall and many other eminent physicists tell us of the results which may be obtained by singing clearly and *persistently*, over solid matter its sympathetic note. We even hear of a bridge being made to sway back and forth with the rhythmic swing of its atoms, which had been excited by the persistent sounding of their response note on a violin.

So we find that in the heart of all created things there exists an atomic movement; that by stimulating this movement to greater activity, forces of an inconceivable magnitude are evolved, and that by a mysterious sympathetic quality which belongs to this soul of matter, *it responds to the precise tone to which its being is set.*

This brings us to "*the Walls of Jericho.*" The way may have been tedious, but a vivid perception of certain minute processes is an indespensable preliminary to what follows. Every condition was present for a perfect experiment in "*Sympathetic Vibration.*"

For six days the encompassing army, preceeded by *seven trumpeters*, was to march once each day around the city. There was to be *absolute silence* while the seven trumpeters were sounding (presumably) the sympathetic note. "Joshua had commanded the people, saying: *Ye shall not shout, nor make any noise with your voice, neither shall any word proceed out of your mouth until I bid you shout, then shall ye shout.*"

For six days the atoms composing the wall were being thus gently stimulated to a rhythmic swing, *undisturbed* by *conflicting rhythms*, thus gradually accumulating a tremendous momentum until the seventh day, when, instead of once, *seven times* they marched around the city, with *seven times* the vibratory force communicated to the swinging atoms, by this time charged with rhythmic energy, and then —"at the seventh time, when the priests blew with the trumpets, Joshua said unto the people: *Shout!* * * * * and when the people shouted with a great shout, * * * the wall fell down flat." The climax has been reached. The atoms, already overcharged with vibratory energy, have not room in which to respond to this tremendous reinforce-

ment of rhythmic stimulus, and are forced apart. The solid masonry is disintegrated.

And does the miracle disintegrate with it? Not at all. It only recedes into obscure fastnesses, after the fashion of other baffling mysteries. The material fact becomes a perfectly natural event; but the *miracle* survives in that Joshua, knowing nothing of vibratory physics, should have planned so perfect an experiment, and that he should have known the precise note to which the doomed wall would respond.

So the miracle does not vanish, but retreats into the more occult and inscrutable region of mind—not matter.

## ACETYLENE.

The production of acetylene upon a commercial basis, so that it can be used for an illuminant as well as the many other uses to which it can be applied, bids fair now to become one of the crowning victories of a century of scientific advance.

For something more than half a century the preëminent qualities of this gas as an illuminant have been well known to the chemist, and its production on a small scale an every-day affair in the laboratory.

Its production on a scale sufficiently large to render it commercially marketable in large quantities has been the dream of the chemist and inventor for years, and has heretofore baffled every scientific attack, the problem having been again and again abandoned as hopeless until acetylene gas, the really perfect illuminant, had come to be regarded as one of the impossible problems of the chemist's art.

It is the rule rather than the exception, however, of this age of progress and surprises that the impossible of the present becomes an every-day matter of the very near future, and the impossible itself is merely a horizon that recedes as we advance. It is strange, however, and worthy of note that this latest and truly most wonderful step in the domain

of pure chemistry is not the result of deep and prolonged research in the laboratory of synthetical analysis, but the accidental discovery of a practical man engaged in the production of aluminum by the electric smelting process.

The story of the discovery of the electric acetylene process is almost romantic. Mr. T. L. Wilson, of North Carolina, superintending the production of aluminum by the electric smelting process, had observed a by-product of the operation, the nature and character of which being unknown to him had excited his curiosity. Lime was present in the fusion mixture from which the aluminum was obtained, as well as carbon in some form, but the greenish-grey by-product, always present, had baffled his knowledge of chemistry and was submitted to some crude tests to determine its composition. On throwing a handful of this apparently new substance into water, violent effervescence of gas ensued, and a residue appeared at the bottom as calcium hydrate or slaked lime.

It was further observed that the gas was ignitable, and would burn at the surface of the water as long as effervescence continued. The substances were, of course, subjected to analysis, and the neglected by-product proved to be a compound of calcium and carbon known to the chemists as calcium carbide ($Ca_2$ $C_2$) which, on being thrown into water, is broken up, the carbon combining with the hydrogen of the water to form $C_2$ $H_2$, known as acetylene gas, which goes off in the effervescence, and the calcium combining with the water to produce calcium hydrate, or slaked lime, which falls to the bottom as a white precipitate.

As simple as that, after all, is the production of acetylene gas on a scale heretofore unknown and considered impossible. To obtain the calcium carbide in the first place was at the same time the important and the accidental part of the discovery, for it seems that the gist of the whole matter lies in the fact that lime and any form of carbon will unite in the powerful heat of the electric arc to form calcium carbide, the sole prerequisite for making acetylene gas on a commercial scale. Wonderfully simple as such a process

may appear, the cost of a very heavy electric current to fuse and cause the combination of the two ingredients, lime and coal dust, will remain as an item that must always prevent this very useful article from being made "dirt cheap."

Still, whenever the electric current for the fusion process can be had from so cheap a source of energy as a near-by water power, the dream of cheap acetylene may still become the stern reality that its present "boom" would have us believe. Its advocates, however, go farther in their sanguine predictions of a revolutionary future for this article.

Coal dust happens to be one of the ingredients required, and ordinary lime the other. The first is so plentiful in the culm banks of the coal regions that fifty cents a ton is a high price, and lime is always plentiful in the neighborhood. But, say they, this cheap fuel (coal dust) of the culm bank will answer to produce the electric current for the smelting process at a figure unprecedentedly low, and thus make the entire process a cheap one from begining to end. So say the enthusiasts, but let us consider for a moment what is acetylene, and what have we got if it can be made on a commercial scale at a low figure.

Acetylene gas, $C_2 H_2$, is a hydrocarbon, gaseous at ordinary temperatures, but easily liquefied at comparatively low pressures, passing off again to the gaseous form as soon as the pressure is removed. It is a colorless liquid, invisible as a gas, but strongly odorous, which is regarded as a decided advantage as an illuminant, as its escape can be readily detected. It enters into the make up of a great many hydrocarbons, particularly the long list of analines, and its possible value otherwise than as an illuminant, though practically unknown, is doubtless great.

A small percentage of this gas is present in the different kinds of illuminating gas made from coal, there being about two per cent. in ordinary coal gas, and it is this small percentage of acetylene in the gas that gives the yellowish-white flame, the pure acetylene flame itself being almost white, the divergence being toward the yellow rather than the red tint. The odor of this gas is unmistakable, and is

familiar to all who are old enough to have smelt the fumes from a tallow candle that has just been snuffed; the strong, pungent odor of the smoke is the odor of the acetylene gas that is given off during the short period of imperfect combustion.

Aside from the claims of interested advocates of acetylene, it is a fact that a thousand feet of acetylene gas is equivalent to about twelve thousand feet of ordinary city gas, or, in short, the illuminating power of acetylene is something like twelve times that of ordinary gas.

There is no residue of combustion and no blue segment to the acetylene flame, and the temperature of the flame is comparatively low, being about nine hundred degrees F. as compared with fourteen hundred for coal gas. The bulk of acetylene in the liquid form is about the one four-hundredth part of the same weight in the gaseous form, from which it is inferred that a small tank of liquid acetylene, with means for taking it off as gas, will answer to light a dwelling for many months.

It is not necessary here to consider all the claims that are made for an article so revolutionary in its advent as this one has at least a chance of being. The whole question today of the value and creative power of this new product resides in the cost of producing the calcium carbide, electrically, by the smelting process. Of this operation we hear little if anything at present, and at this writing it is not known that any single smelting plant is producing calcium carbide on a marketable scale. It is to be hoped that this bastard child of scientific progress will do honor to its humble parentage, and not prove itself the biggest bubble instead of the greatest chemical step of the closing century.

XUM

## NOTES ON THE PROGRESS OF SCIENCE.

### PHILOSOPHY AS A BUSINESS.

Herbert Spencer's first important work, "Social Statics," was published in 1850, when he was just thirty. The great work of his life—the "System of Synthetic Philosophy"—was taken up in earnest ten years later.

In his evidence given before the Commission on Copyright, he tells in plain words the story of his hard and noble fight during the unrecognized days of his early manhood. For his first book, "Social Statics," in 1850, he could not find a publisher willing to take any risk; so he was obliged to print it at his own cost and sell it on commission. The edition consisted of only seven hundred and fifty copies, and it took no less than fourteen years to sell. Five years later he printed the original form of the "Principles of Psychology." Again no publisher would undertake the risk, and he published it on commission. Once more seven hundred and fifty copies were printed, and the sale was very slow. "I gave away a considerable number," says Mr. Spencer, pathetically, "and the remainder sold in twelve and a half years." During all that time, we may conclude from the sequel, he not only made nothing out of those two important and valuable books, but was actually kept out of pocket for his capital sunk in them.

"Before the initial volume, 'First Principles,' was finished," he observes, "I found myself still losing. During the issue of the second volume, the 'Principles of Biology,' I was still losing. In the middle of the third volume I was losing so much that I found I was frittering away all I possessed. I went back upon my accounts, and discovered that in the course of fifteen years I had lost nearly one thousand and two hundred pounds—adding interest, more than one thousand and two hundred pounds. As I was evidently going on ruining myself, I issued to the subscribers a notice of cessation."

He had been living, meanwhile, in "the most economical way possible;" in spite of which he found he had trenched to that large extent on his very small capital. Spartan fare had not sufficed to make his experiment successful. Nevertheless, he continued to publish, as he himself bravely phrases it, "I may say, by accident." Twice before in the course of those fifteen weary years he had been able to persevere, in spite of losses, by bequests of money. On this third occasion, just as he was on the very point of discontinuing the production of his great work, property which he inherited came to him in the nick of time to prevent such a catastrophe.

Most men would have invested their money and fought shy in future of the siren of philosophy. Not so Mr. Spencer. To him life is thought. He went courageously on with his forlorn hope in publishing, and it is some consolation to know that he was repaid in the end, though late and ill, for his single-minded devotion. In twenty-four years after he began to publish he had retrieved his position, and was abreast of his losses. Twenty-four years of hard mental work had passed, and at the end of it he found himself just where he started. It is thus the world usually rewards its best thinkers.—*Review of Reviews.*

### THE HEAT OF THE SUN.

Professor S. P. Langley, in a recent interview, made the following remarks in regard to the solar heat:

"Putting it briefly, it is enormous, beyond conception, for there is enough to warm two thousand million worlds like ours, and every minute there is heat enough of the sun's heat falling on the earth to raise to boiling thirty-seven thousand million tons of water. But this heat which falls on the earth is not a thousandth part of one per cent. of what the sun sends elsewhere, and all the coal beds of Pennsylvania, for instance, though they can supply the country for hundreds of years, would not keep up this heat during the one-thousandth part of a second."

He proceeded to say that the amount of heat thus represented is inconceivable, and in regard to the possibility of

utilizing that portion of it which reaches the earth, remarked:

"The force is there. The method of preserving and applying it economically has yet to be invented. My experiments on Mt. Whitney, in the Sierra Nevadas, showed that if we could save it all and use it for our steam engines, it would give about a horse-power for every square yard of ground. We hear a great deal about the immense power from the recent utilization of Niagara, but the sun power which is, so to speak, wasted daily on the little District of Columbia, is hundreds and hundreds of times as great. The heat on the surface of the Island of Manhattan, or that occupied by London, could at noontide drive all the steam engines of the world. So far there have been no practical inventions for utilization of this enormous power. At the Paris Exposition of 1878 there was a reflector which drove a steam engine which worked a printing press. Ericsson made a solar engine which it was thought might be used in the pumping up of the waters on desert lands. The probability is that the day will come when we will use all this force. When it does the deserts of the world, with their enormous sun power, may become the great centres of manufacture and of civilization."

### THE MISSING LINK.

The interesting find made a year ago in the island of Java, by Dr. Eugene Dubois, of the remains of what may have been a man or may have been a man-like ape—described in Number 4 of the NEW SCIENCE REVIEW—has recently excited fresh attention through the exhibition of these remains in Europe by Dr. Dubois. These fossils, consisting of the roof of the skull, a molar tooth, and a femur, have been ascribed by the finder to a new genus of anthropoids, called by him *Pithecanthropus*, to which he has added the specific title *erectus*, from the fact that the femur indicates that the animal stood upright. This claim has been variously received, some naturalists accepting it as well placed, others believing the remains to be those of a man. Professor Virchow, one of the latter,

and an eminently conservative naturalist, on examining the actual remains, expressed his opinion in favor of Dr. Dubois' views, so far as they can be sustained on the evidence of such incomplete material. Other naturalists in England and elsewhere, having been shown the material by Dr. Dubois, seem inclined to a similar conclusion, and the weight of opinion in favor of this being an actual "missing link" has grown considerably. In America as yet there have been nothing but photographs of this interesting skull and its accompanying relics, and these furnish insufficient data for a definite conclusion. There is reason to believe, however, that the original material may before long cross the Atlantic, in which case American naturalists will have a suitable opportunity to add their voices, pro or con, to those of their European brethren.

BY BALLOON TO THE NORTH POLE.

A new and interesting venture in Arctic exploration is that projected by S. A. Andree, a Swedish adventurer, under the auspices of the Royal Swedish Academy of Science. He proposes to make the journey by balloon, starting from one of the islands northwest of Spitzbergen, and taking advantage of the northwest winds which often blow for a long time together over that region. He is having a balloon constructed impervious enough in texture to hold the gas for thirty days, with provision to refill with gas, if necessary, in the Arctic Circle. The balloon is to be powerful enough to carry three persons, with instruments and four months' provisions, the whole to weigh about three tons. Though trusting mainly to the winds, he hopes to gain some steerage powers through the aid of guide ropes which will drag on the ground and check the drive by the wind. It has been found possible, through this means, to turn twenty-seven degrees from the direction of the wind. The journey is proposed for the summer of 1896, and the adventurer hopes that a few days of fair weather and favorable wind will give him better results than have been attained in centuries of Arctic voyaging. Baron Nordenskjold, the famous polar explorer, and Dr. Nils

Ekholm, one of the best informed meterologists in Europe, deem the enterprise a very promising one.

### LIQUID AIR IN COMMERCE.

Just as steam may be transformed into water by cooking or compressing it, so may the atmosphere be rendered liquid by the same means, save that the cooling temperature is very much lower than in the case of steam. Its production has heretofore been entirely a laboratory experiment, yet steps have been taken to turn out liquid air as an article of commerce, it being the most powerful of all refrigerators, and the product also rich in oxgyen gas, for which there is a large industrial demand. The necessary reduction of temperature to the critical point of air has been effected by the successful employment of liquefied gases boiling at lower and lower points on the scale, the final decrement of heat being due to the rapid evaporation of the product itself. The new apparatus for its production dispenses with intermediate cooling agents, and relies on initial compression of the air by powerful engines and a subsequent partial expansion of the compressed air under regulated conditions. Compression of air causes heat to be produced, as illustrated in the lecture-room experiment of forcing a piston suddenly down a cylinder and causing the ignition of a piece of touch paper by the heat thus produced. If, while the compression is maintained, the cylinder and its air be cooled to the original temperature, then, on allowing it to expand to its original volume, there will be a fall in temperature corresponding to the rise on compression. If this air could now be used to cool another body of air before expansion, it is evident that the latter, after expansion, would reach a lower temperature than the first batch of air, and, by so continuing the process, extremely low temperatures may be produced. This is the principle upon which the new liquid-air-producing apparatus depends.

By carrying this cumulative cooling effect sufficiently far the circulating air is at last brought to its critical point and liquefies, so that a continuous stream of liquid air is merely a question of engine power. As stated, liquid air is a pow-

erful refrigerator, for it must absorb a great amount of heat before attaining its previous condition. It is also rich in oxgyen, containing about seventy per cent., and the gas thus produced compares favorably in price with oxgyen produced by methods now in use.

### ARGON UNDER QUESTION.

There is no new thing under the sun: even argon is suspected. At the meeting of the Chemical Society, held at Burlington House, Professor Dewar essayed to prove that none of "the claims of contemporary scientific investigators to originality in obtaining liquid air and oxygen" were worthy of respect. In his judgment nothing really fresh had been discovered in this field of research since 1875. Professor Ramsay, the discoverer of argon and helium, was present, and took part in the discussion of Professor Dewar's address, but he seems to have contented himself with remarking that Olszewski had recently succeeded in obtaining more than half an inch of liquid hydrogen in a test tube. It seems probable that in the process of liquefying air in quantity above described, argon might appear as a considerable bi-product, since in dealing with the great volumes of air, required much argon, and possibly other minor constituents of air, would be involved. It may, therefore, serve as an important method of new discovery.

### A NEW RIVER IN CANADA.

We hardly look at this late day for geographical discoveries of leading importance in America; yet one such is announced in a locality not far away from the borders of the United States. Sir Robert Bell is said to have discovered a very large river in Canada, rising near the upper waters of the Ottawa and flowing into James Bay, after draining a large and hitherto unexplored area. The volume of water is so great as to make the river rank among the largest in Canada, and it is navigable through most of its course. At about one hundred miles from its mouth it is broken by a series of rapids. It is proposed to name it Bell River, in honor of its discoverer.

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### AMERICAN AND RUSSIAN PETROLEUM.

A peculiar fact in respect to petroleum is the difference of conditions under which that oil occurs in Russia and America. In the former it is found in strata of the tertiary period, usually a formation resembling a quicksand and at depths of only a few hundred feet—in our own country it occurs at great depths in the older compact sandstones and limestones of the Carboniferous, Devonian, and Silurian periods. The oil of Russia consists of a class of hydrocarbons known as naphthenes, belonging to the benzine groups, while our American oil is mainly composed of paraffines; it is to this difference that the great variation between the products from these oils is due, for, while American oil yields a very large proportion, say about 70 per cent., of illuminating oil exactly suited for combustion in our ordinary lamps, the Russian oil produces far less of such oil and a larger proportion of high-class lubricating oil. The Russian illuminating oil also requires to be burned in a modified form of lamp with a more perfect draught, in order to overcome its tendency to produce a smoky flame, and it is largely this fact which has prevented the consumption of Russian oil for light abroad.

### ORIGIN OF ORE DEPOSITS.

Ingenious theories have from time to time been advanced by scientists relating to ore deposits—the cause, time, manner, etc.—and among the most recent and able of these Prof. Le Conte may well be ranked. His conclusion is that such deposits—using the term in its widest sense—may take place from many kinds of waters, but especially from alkaline solutions, these being the natural solvents of metallic sulphides—and the latter are usually the original form of such deposits; they may take place from waters at any temperature and pressure, but mainly from those at high temperature and under heavy pressure, because on account of their great solvent power such waters are heavily freighted with metals, and the depositing waters may be moving in any direction—that is, may be up-coming, horizontally moving, or even

sometimes down-going, but mainly up-coming, because, by losing heat and pressure at every step, such waters are sure to deposit abundantly. Furthermore, Prof. Le Conte says that deposits may take place in any kind of water-ways, such as open fissures, incipient fissures, joints, cracks, and even in porous sandstone, but especially in large open fissures, the latter being the main highways of ascending waters from the greatest depths; deposits may also be found in many regions and in many kinds of rocks, but mainly in mountain regions and igneous rocks.

### THE LUNAR CRATERS.

In the opinion of Prof. Asaph Hall, as recently expressed, the problem of the physical constitution of the moon is one that yet remains to be solved. Of the "craters" scattered all over her surface, the volcanic theory of formation fails, he thinks, to be satisfactory. Another notion to which he refers is that, ages ago, the moon was surrounded by swarms of "moonlets," which eventually were precipitated upon the moon's surface, forming the craters now seen. Thus, the Mare Imorium was created by the impact of a huge moonlet, ninety miles in diameter, which, in striking, was raised to such a high temperature as to melt its substance. An immense hole or "crater" being formed where it struck, the molten material of the moonlet spread in every direction for a vast distance, partly filling up other craters; fragments flew to distances of a thousand miles, scoring out deep furrows, one of the latter, as now seen, being 187 miles long, 10 to 25 miles broad, and with a depth of 11,000 feet.

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# REVIEWS.

A Manual of Ethics, By John S. MacKenzie, M. A. Price, $1.50. (W. B. Clive, University Correspondence College Press, London and New York.)

It would be difficult to find a more compact, yet full and clearly rendered, exposition of the science of ethics than is presented in this useful volume. It is presented to the public as a text-book, a volume of the University Tutorial Series, some of which we have previously noticed, and is certainly one of the most important of the series. The subject of ethics, long as it has been before the world, and handled as it has been by many of the ablest of the world's thinkers, is one concerning which the public at large know very little theoretically, though practically dealing with it at almost every moment of life. To most of readers, therefore, it will be a revelation to discover how fully this subject has been subjected to the dominion of scientific thought, and over what a wide scope the domain of practical virtue extends. The whole field of ethical thought and action is admirably dealt with by Mr. MacKenzie, with a lucidity of treatment, and a logical sequence of arrangement, which renders this ordinarily difficult subject as easy of comprehension as many of the simpler subjects of thought.

It may, indeed, be said that the pupil who makes a thorough study of this work will find himself in complete familiarity with a science which has hitherto had a repelling aspect to students. In no work with which we are acquainted is there such an excellent division of the subject into its logical sequence of parts, and such a clear and forcible explication of each, the reader being led on step by step up an ever-ascending stairway to look back with surprise from the top on the difficult path which he has so easily traversed. From a literary point of view as much may be said for the book. Its style is easy, crisp and forcible, its tone of thought excellent, while its clearness of statement and philosophical exactness of arrangement are all that could be desired. No reader can complete its perusal without being greatly aided in the art of weighing and determining the force and validity of argument, and helped in that introspective habit which underlies all useful thought.

This book was prepared for the use of private students, and especially for those who are preparing for such examinations in ethics as those conducted by the University of London. It will, however, undoubtedly be of great use to other classes of students, and has been adopted as a text-book in many American institutions of learning. Among these may be mentioned Yale College, Brown University, Columbia University, Iowa College, Ohio State University, Iowa Wesleyan University, De Pauw University and University of Kansas. This list might be considerably extended, but the indorsement of the institutions named will be sufficient to sustain what we have said concerning its value, clearness and orderliness of statement, and to suggest to general

readers that in this work they may find a simple and comprehensive explication of a subject of which a wider knowledge than is now possessed is of the highest importance.

EUROPE IN AFRICA IN THE NINETEENTH CENTURY, BY ELIZABETH WORMELEY LATIMER. Price, $2.50. (A. C. McClurg & Co., Chicago.)

The authoress of this work is by no means a tyro in the class of historical composition to which it belongs. The high success met by her preceeding works: "France in the Nineteenth Century," "England in the Nineteenth Century," "Russia and Turkey in the Nineteenth Century," etc., argues strongly for their literary merit and timely character, and for the favor with which the reading public hails all well-written historical records of this marvelously progressive century in which we live. The present work is one of very live and timely interest. The "Dark Continent" has been so rapidly and widely thrown open to the light of modern investigation, and the cycle of discovery has been followed by such a marked example of the "game of grab" in which the nations of Europe are such experts, that one stands bewildered before the multitude of changes, while the political conditions of the continent shift with the rapidity of a kaleidoscope before his eyes. All readers who have attempted to follow the course of this shifting record cannot but be thankful to the authoress of this able work in enabling them to obtain a clear comprehension of the situation, and a point of vantage from which they can follow the future movements of the political game with more ease and comprehension. The story begins in Egypt, passes to the upper Nile regions and Abyssinia, and goes on to trace the movements of the English, French and Germans in Africa, yielding us, as the authoress remarks, a series of events none of which have reached their end, a volume of "short yarns," many of them very difficult to trace, and whose denouements must lie in the coming century. Students of history should be especially thankful for this roadside outlook over the stream of events.

THE SCIENCE OF THE SOUL, BY LOREN ALBERT SHERMAN. (The Sherman Company, Port Huron, Mich.)

We have here the science of the soul, not from the point of view in which it is pursued in our universities, that of physiological experiment and the study of aggregates of mental phenomena, but from the standpoint of the spiritist, and of the evidence claimed to be given by disembodied souls. This is sufficiently indicated in the sub-title of the work: "A Scientific Demonstration of the Existence of the Soul of Man as his Conscious Individuality Independently of the Physical Organism, of the Continuity of Life and the Actuality of Spirit Return." We should all be heartily glad if Mr. Sherman, and those of his way of thinking, could succeed in such a scientific demonstration, no matter on what it was based. It would do away with certain intruding doubts concerning our future which force themselves into the mind of every man, and by many cannot be routed out. But such a demonstration is by no means easy to make, and ordinarily when given has a convincing force only on the mind of its maker. Mr. Sherman, for instance, after considering the phenomena of hyp-

notism, clairvoyance, etc., and the philosophy of the infinite, proceeds to present the theory of the future life entertained by spiritists, and to strengthen it by an extended narrative of spirit manifestations of various kinds, some of them quite interesting, though we cannot say quite convincing. The great difficulty with such demonstrations is that they cannot be repeated by all students of psychology. They are local and personal, and while they may be evidence to their recipient, are rarely so to the world at large. The possibility of fraud, credulity, lack of accuracy, of observation and of scientific acumen, is so great that the great world views with critical doubt all such evidence, convinced in its own wise mind that if it had been there it would have seen through the presupposed fraud. As for the reviewer, he has no opinions. It is his mission simply to present.

ETIODORHPA; THE END OF EARTH, BY JOHN URI LLOYD. (Published by the Author, Cincinnati.)

This work, while vitally unlike that just noticed, may fitly follow it, as it deals with a somewhat similar philosophy, and seems to indicate a belief in spirit phenomena. It is, however, a romance, and a very curious and interesting one, of the class of Astor's "Journey in other Worlds," and similar products of the scientific imagination. Here are we given "The Strange History of a Mysterious Being, and the account of a Remarkable Journey;" not, however, in distant planets, but in the interior of our own mother earth. The hero of the romance, a deep student of alchemy, and member of a band of pursuers of the hermetic art, offends his fellows in a way that renders necessary his banishment from earth. He is, therefore, forced to descend into a Kentucky cavern under the guidance of a strange being, and gradually descends into the depths of the earth till he is hundreds of miles below the surface, and at the roots of volcanic phenomena. With the wonderful things he experiences we are not here concerned. But with the fiction is combined an explication of a philosophy of the universe which is of much interest, and a study of the physical forces which is amply worthy of consideration. Mr. Lloyd is a thinker of ability, while as a writer he possesses a clear and flowing literary style of much merit. Aside from its value as a work of philosophy and romance, this volume has a special merit of its own as a magnificent example of the typographical art. The paper, press-work, binding, illustrations, are all worthy of the highest commendation, and it has rarely been our fortune to meet with so superbly made a volume. It can be recommended alike for its matter and its manner.

"THE EVOLUTION OF AN EMPIRE, A BRIEF HISTORICAL SKETCH OF ENGLAND," BY MARY PARMELE. (William Beverley Harrison, New York.)

This work is one of a series of "Evolution of Empire" volumes, including "Germany" and "France." Its purpose, like that of its predecessors, is to present a brief view of an extended historical record, to paint on a very small canvas the essential details of what is usually given as a very large picture. It attempts mainly to trace to their sources some of the currents which enter into the life of England of to-day, and to indicate the starting-points of some of the threads which are woven into the composite texture of the England of

the nineteenth century. As Mrs. Parmele very notably says, there are "two things most closely interwoven with the life of England, RELIGION and MONEY have been the great evolutionary factors in her development," and this theorem she proceeds to sustain in a rapid running glance at the historical development of the English nation. The work is certainly worthy of high commendation. We do not know where we have met one that contrives to tell so much in so brief compass. It should be of great value as a school reader for beginners in the study of English history, planting the long route with milestones of progress from each of which an extended view may afterwards be taken, and serving as a capable digest of the intricate story which older readers may peruse with pleasure and advantage.

THE HERSCHELS AND MODERN ASTRONOMY, BY AGNES M. CLERKE. Price, $1.25. JUSTIS VON LIEBIG, HIS LIFE AND WORK, BY W. A. SHENSTONE, F. I. C. Price, $1.25. (Macmillan & Co., New York.)

We have here before us two volumes of the "Century Science Series," a series of biographical sketches of men eminent in science, which is fortunate in having so capable an editor as Sir Henry G. Roscoe. One work of this series, "John Dalton and the Rise of Modern Chemistry," we have previously reviewed. The series, indeed, is by no means solely biographical, but deals with each character in connection with the particular science to which he was devoted, and in this way usefully combines the story of a life with the record of a science.

This is particularly applicable in the case of the Herschels, who performed the ablest pioneer work in clearing the field for the development of modern astronomy, and whose services in the progress of this science were of incalculable value. The story of the life and work of William and John Herschel, and of Caroline Herschel as well, is one that is full of deep interest, and their close devotion to their astronomical pursuits, with the succession of discoveries made, is in this capably written work invested with almost the fascination of romance. In the case of Liebig, we have to consider the science of chemistry in its more recent aspects. Liebig is known widely for his "extract of meat," but is not generally known as an able and indefatigable scientist, whose work had much to do with "the causes which conduce to the movements of great civilized societies." This little work comes, therefore, somewhat in the form of a discovery, and has much to tell the reader, which he will find of profit and interest.

MOLECULES AND THE MOLECULAR THEORY OF MATTER, BY A. D. RISTERN, B.S. (Ginn & Company, Boston.)

We have to thank Mr. Ristern for this work, which serves to fill an important gap in the list of monographs of science. The history of the molecule has hitherto been a scattered one. Many books dealt with it in passing, but no previous writer seems to have deemed it important enough to be treated separately, and we must credit Mr. Ristern with a happy idea in preparing for us this brief, but well-filled volume. The story of the molecule is here given in the form of a lecture, and is really the expansion of a lecture. It

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gives us the elements of the molecular theory of matter as it is held to-day, excluding all subjects that have no immediate bearing on the molecule, thus usefully isolating this important subject, and enabling readers to gain a fuller and closer grasp of it than has been hitherto easy to obtain.

UNCLE SAM'S HOMILIES ON FINANCE, BY CHARLES ELTON BLANCHARD. (The Current Events Company, Cleveland, O.)

We have not here to do with science, but with a work made up of sarcasm, shrewd observations upon the monetary question and trenchant criticism of some recently published popular works on finance. Just what side the author takes on the great silver question we have not discovered from the cursory glance, which is all we have had the time to give his work, but he is evidently decidedly opposite to the well-known "Coin's School," concerning which we must blushingly confess similar ignorance. All we need say in conclusion is, that all who have learned their lesson in "Coin's School" had better study what "Uncle Sam" has to say on this large subject.

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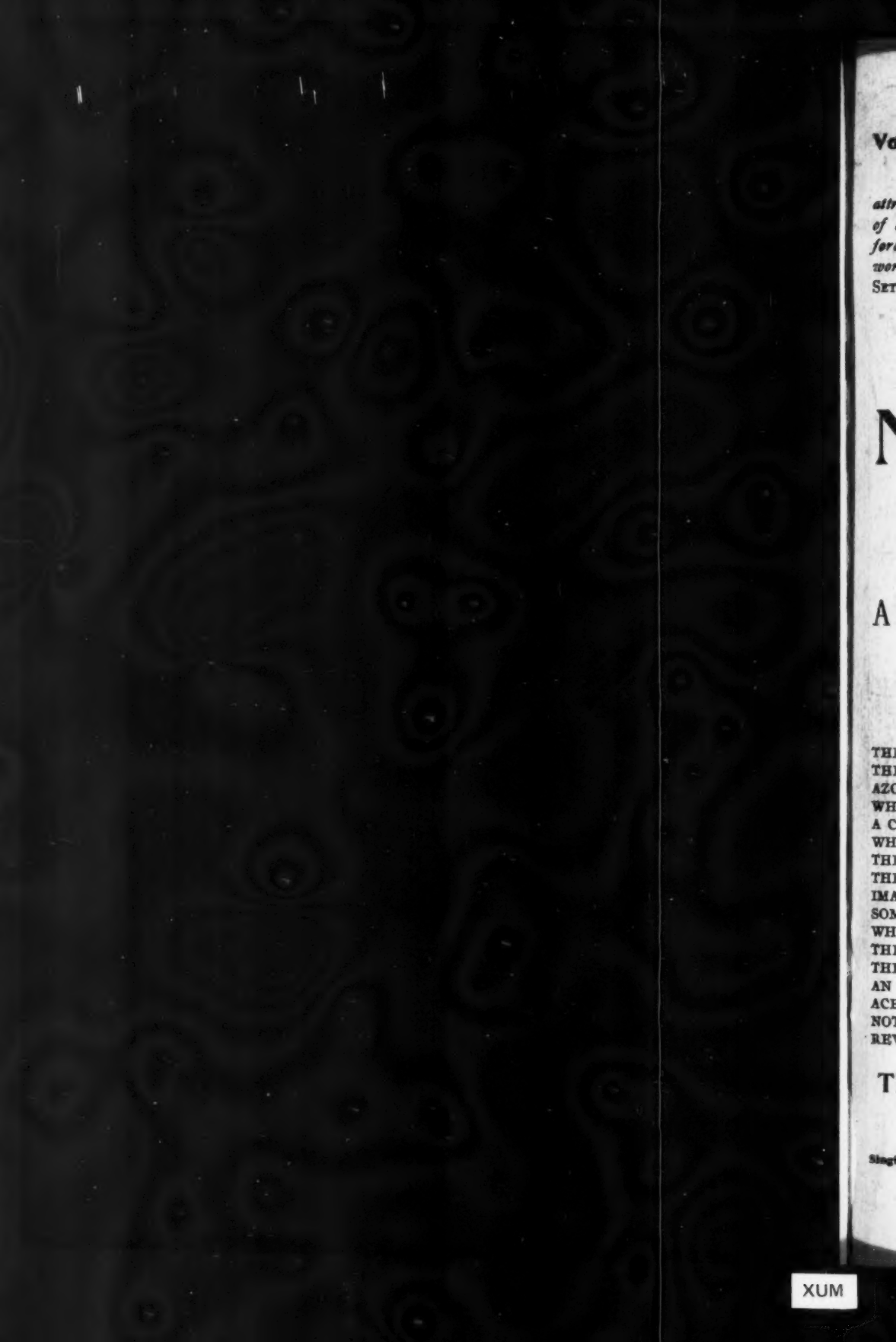

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*"There is no force in nature that is not directly derived from light. The physical forces, attraction and repulsion, with all their modifications, are the positive and negative principles of light. The vital forces are the same principles of light acting in organic forms as nerve-forces. The objective sum is not the source of light. It is the sympathetic transmitter to the worlds of its system; and of the nervous system, in men and animals, the same is true."*—SETH PANCOAST, M.D.

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# KEELY AND HIS DISCOVERIES.

## AERIAL NAVIGATION.

BY

MRS. BLOOMFIELD MOORE.

*The Universe is ONE. There is no supernatural: all is related. Nothing exists but substance and its modes of motion.*—SPINOZA.

*In vibratory physics spirit is substance.*—C. J. M.

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# From the London REVIEW OF REVIEWS.

Paul Janet, in writing of the origin of the philosophy of Comte, said, of the different and contrary conceptions found in various so-called systems, that they arise, he thinks, from the fact that no true system of philosophy has yet been propounded, and that only when a "véritable système" has had birth will all these diversities and contradictions disappear from the teachings of the schools.

However willing thoughtful men and women may be to admit that science has done a great work in cleaning away "the kitchen middens of superstition," they see that "her methods are at fault and that the results are disappointing failures." Edward Carpenter, in a criticism on modern science, says: "Science has failed because she has attempted to carry out the investigations of nature from the intellectual side alone, neglecting the other constituents necessarily involved; she has failed because she has attempted an impossible task, for the discovery of a permanently valid and purely intellectual representation of the universe is simply impossible, and it must be confessed that science now finds herself, in almost every direction, in utterly hopeless quandaries. The views of science are like the views of a mountain; each is only possible as long as you limit yourself to a certain standpoint; move your position and the view is changed, and just where she is most ignorant she is most definite and dogmatic."

If, as Carpenter asserts, science has landed herself in pure absurdities in every direction, while the unknown thing remains unknown, the independent existence around the corner still escapes us, the time has come in which it may be well to look into a philosophy that for the first time gives us a system which teaches "a vast organization, absolutely perfect and intimately knit, from its center to its utmost circumference, existing embryonic in every individual man, animal, plant, or other organism, the object of all life, experience, suffering and toil—the ground of all sensation, and the hidden, yet proper, theme of all thought and study."

This is the philosophy which Keely's system discloses, as made known in Mrs. Bloomfield Moore's book, "Keely and His Discoveries." It is asserted that Mr. Keely has demonstrated his ability to "hook on his machinery to the machinery of nature," drawing therefrom a harmless propelling and controlling power, which, it is claimed by him, is the force that controls the universe, and the only one safe and suitable for navigating the highways of the air.

The book is dedicated to Professor James Dewar, M.A., LL.D., F.R.S., M.R.I., "in admiration of his distinguished services for science and in grateful acknowledgment of his prolonged and steadfast interest in Keely's work of evolution."

In the words of the Rev. John Andrew, who has written the preface, "the aim of his volume is to show the course of events in relation to Keely's researches, and to open the mystery of how it came about that he should have been so much misunderstood and hindered," as he has been, as well as to bespeak for him the sympathy and patience which he needs, and will continue to need, until his system is completed to that degree of perfection which will enable him to patent his air-ship. Another step taken toward that conquering of the material world which must precede the advent of the reign of the spirit, Renan asserts in his "Avenir de la Science."

After Mrs. Bloomfield Moore's book was completed and in print, she received from Mr. Grant Allen the following prefatory note, intended for its pages, and which cannot fail to create an interest in the publication:

"In this volume Mrs. Bloomfield Moore endeavors to give some account of the physical philosophy of Mr. Keely, who claims to be the discoverer of an unknown energy. There can be no doubt at all that Mrs. Moore is thoroughly competent for the task she has set herself, for no other person has been so intimately associated with Mr. Keely's work during the last ten years, and no other has followed it throughout with such disinterested and single-hearted enthusiasm. It is impossible not to sympathize with so rare a determination to assist struggling genius. In Mrs. Moore's opinion, Keely has made great discoveries, and she has generously devoted no little time and trouble to aid the inventor in gaining public recognition. Now, I am a heretic in physics myself, though my heresies are not the same as Mr. Keely's, and, therefore, I am interested in the general principle that all heresies should meet, at least, with a fair and open trial at the bar of scientific opinion. That fair and open trial is now demanded for the views promulgated in the present volume. All its author asks is an impartial judgment, and Mrs. Moore is herself so conspicuously honest and candid that she deserves no less at the hands of specialist critics.

"The work, as I regard it, is rather concerned with Mr. Keely's theories, and with Mr. Keely's philosophy, than with his actual performance. Now, what the world most wants is rather proof positive and material of the existence and reality of the unknown power. As soon as it can be made to 'do work' (if I may borrow the very unsatisfactory phrase of the modern physicist), practical men, I take it, will be only too glad to employ the latest known form of energy. It appears, however, that grave difficulties are supposed by many to stand in the way of the practical utilization of the alleged motor. Till those difficulties have been overcome it is but natural that an incredulous world should stand by and suspend its judgment, if, indeed, it does not refuse to so much as suspend it. But Mr. Keely is fortunate in having found a supporter whose faith rises to the full height of so painful a situation. If success should ever crown his life-long efforts, it will be largely to Mrs. Moore's unfaltering encouragement for the last ten years that the world will owe its new motor.

"With regard to the theoretical part of the present work—and it is mainly theoretical—I should be inclined to say that a great many of the principles for which Mrs. Moore contends have now been reckoned among the probabilities, or even the certainties, of science. Such are the principles of the unity and uniformity of energy, the reluctibility of all energies to a single ultimate kind, and the underlying antagonism between forces and energies. But others, more novel, are couched in a new terminology of Mr. Keely's invention, and are difficult for the physicist to correlate with the ordinary principles known to science. To say this is not, of course, equivalent to condemning them, for every new science has had to begin by inventing its own terminology, and electricity, in particular, passed at first through a stage of very curious nomenclature, proved by later research to be in large part erroneous. But the language in which Mr. Keely clothes his ideas is so peculiar to himself that it cannot readily be followed by physical investigators. Much of it, I must confess, conveys little meaning to me. Nevertheless, I have honestly done my best to grapple with the reasoning involved, and I shall watch henceforth, with the greatest interest, the final developments of Mr. Keely's mechanism.

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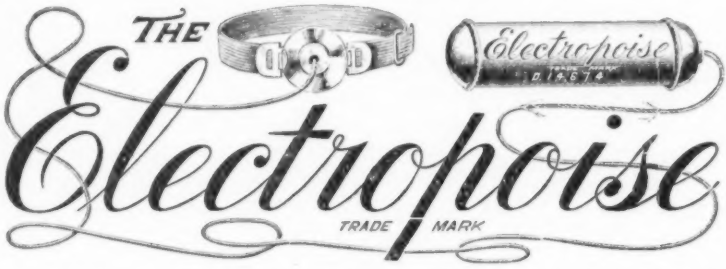


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Digestants such as pepsin, lactopeptine, etc., and stomachic stimulants were each tried in vain. There was no cessation of the neuralgic pains and the patient's general health and nutrition became seriously impaired.

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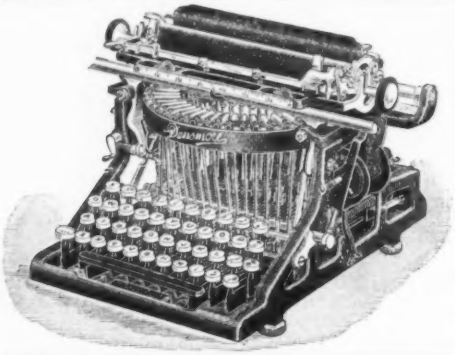

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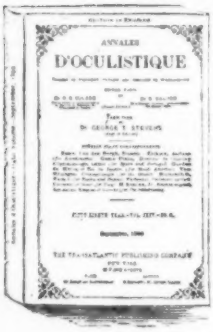


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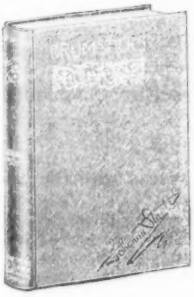

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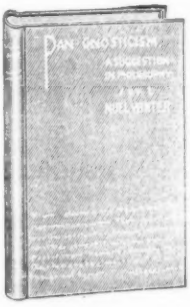

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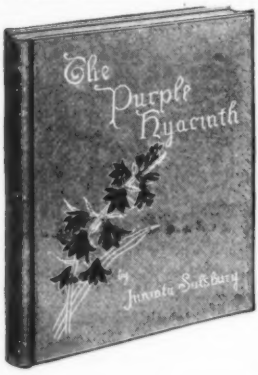


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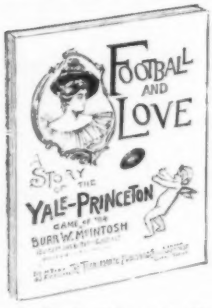


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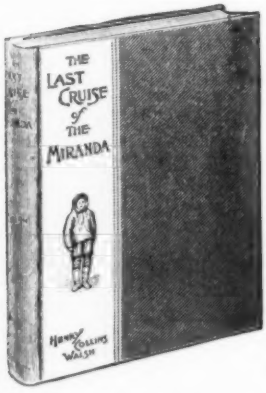


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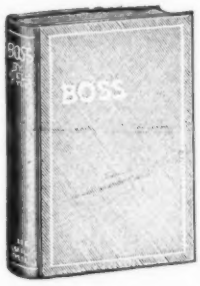


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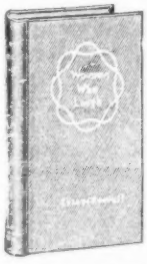

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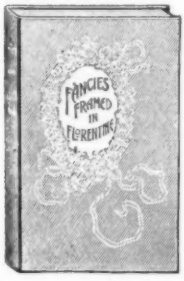


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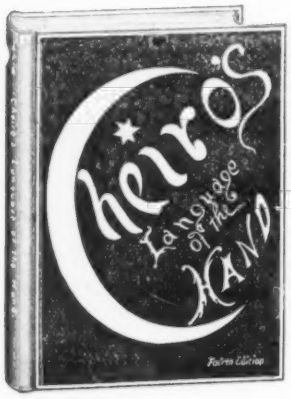


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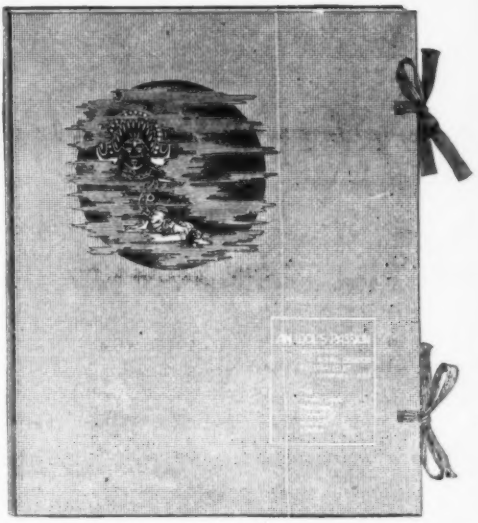

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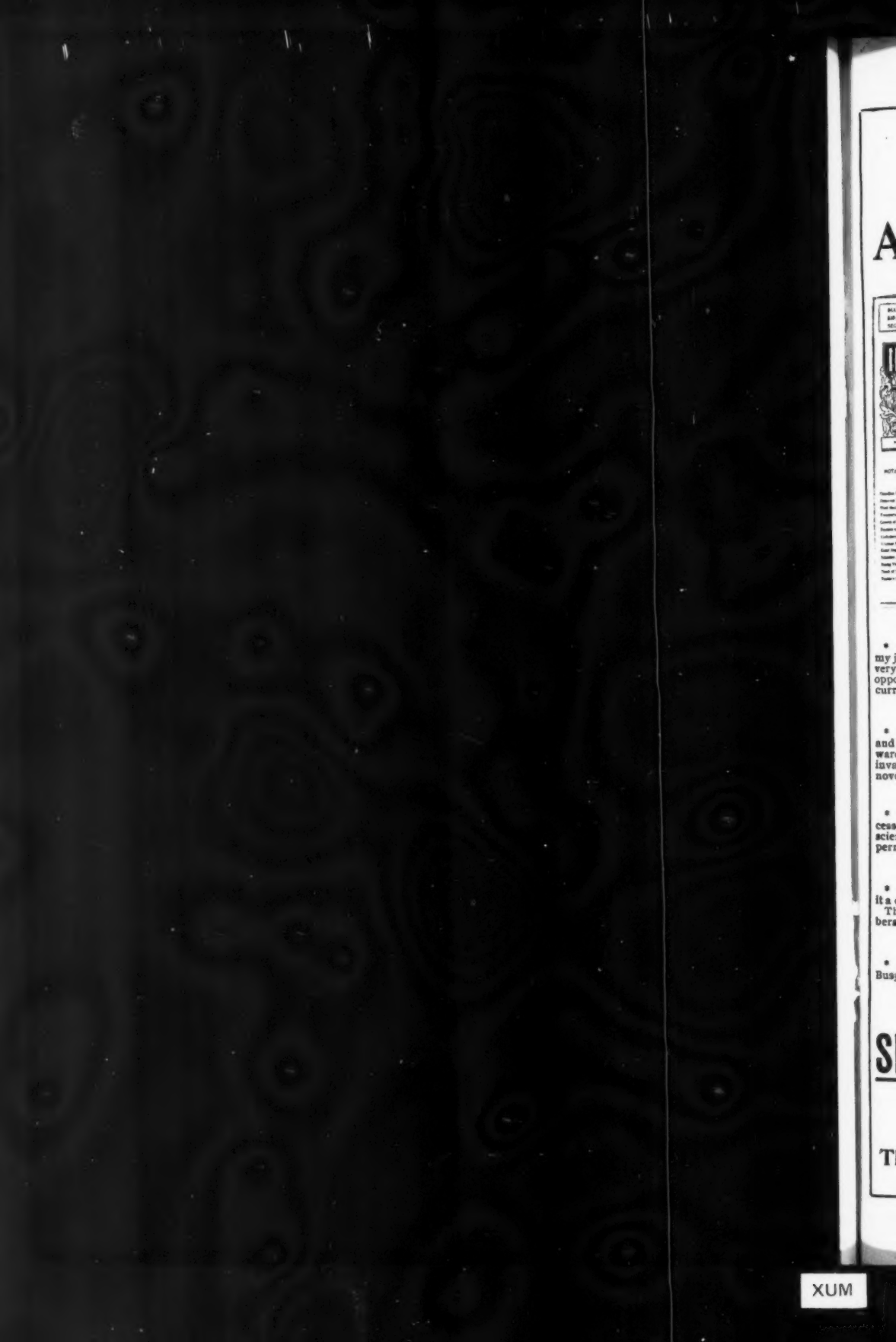

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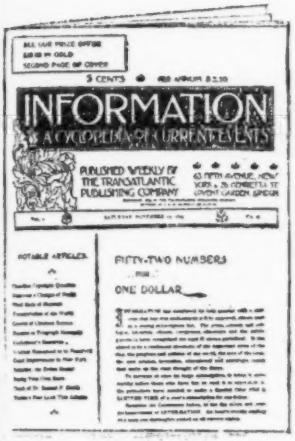


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